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Monthly Report

November 1987 Number 231

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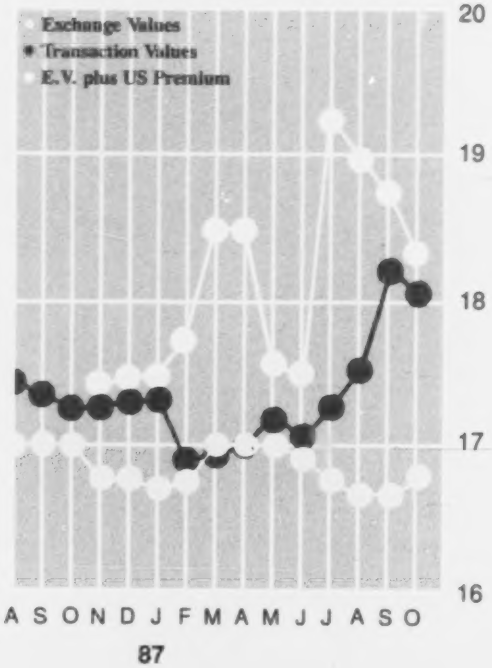

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EXECUTIVE SUMMARY
REPORT 231
(All data as of October 31, 1987)

Exchange Value
$16.75, up $0.10

The **Exchange Value** is **$16.75** per pound U_3O_8, up $0.10 since last month. The US Premium (relative to the Exchange Value) is $1.65, down $0.45 since last month.

UF_6 Value
$47.00, up $0.25

The **UF_6 Value** is **$47.00** per kilogram U as UF_6, up $0.25 since last month. The US Premium (relative to the UF_6 Value) is $3.10, down $1.15 since last month.

Transactions

Thirteen recent natural uranium sales are reported, involving **9.4 million** pounds equivalent U_3O_8. Eleven of the sales involved spot or near-term delivery, and ten met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **5.7 million** pounds U_3O_8 equivalent, down 700 thousand pounds since last month. Active spot and near-term **uranium demand** totals **2.0 million** pounds, up 260 thousand pounds from last month. The spot and near-term **supply-demand ratio** decreased to **2.9 to 1**.

Transaction Value
$18.05, down $0.15

The **Transaction Value** is $18.05 per pound U_3O_8, **down $0.15** since last month. The calculation includes transactions involving a total of 3.7 million pounds U_3O_8 and equivalent UF_6, of which 2.0 million pounds are US-origin, and covers a period of 3 months.

Loan Rate
4%, unchanged

The **Loan Rate** is **4 percent** per annum, unchanged. Two loan transactions are reported.

Conversion Value
$1.90, unchanged

The **Conversion Value** is **$1.90** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 330 thousand pounds U as UF_6. Active demand totals 660 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for delivery within one year: $69, down $4.00

The **SWU Value** at .3% tails assay and for delivery within one year is **$69** per SWU, down $4.00 since last month. No secondary market SWU transactions are reported.

* * *

Raw Materials

Although current regulations covering uranium tailings affect the design and operation of today's mills, numerous now-inactive uranium milling sites operated for many years without regulation. This article examines how current laws and regulations are being applied to the cleanup and stabilization of uranium tailings sites throughout the USA.

Australia

For some time, the Australian government has been under pressure to change its floor-price policy and its "three-mine" policy. This article discusses how both policies may be undergoing significant changes that could greatly affect Australia's position among uranium producers.

South Africa

Third-quarter 1987 output from Chamber of Mines producers declined 14.5 percent, largely the result of drops in production at Randfontein and Vaal Reefs, which were adversely affected by the mineworkers strike in August.

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NUEXCO REPORT 231 FIGURES OF THE MONTH (October 31, 1987)	This Month (Report 231)	Last Month (Report 230)	12 Months Ago (Report 219)
Exchange Value (\$US per pound U_3O_8)	16.75	16.65	17.00
US Premium for the Exchange Value (\$US per pound U_3O_8)	1.65	2.10	—
UF_6 Value (\$US per kilogram U as UF_6)	47.00	46.75	48.00
US Premium for the UF_6 Value (\$US per kgU as UF_6)	3.10	4.25	—
Transaction Value (\$US per pound U_3O_8 equivalent)	18.05	18.20	17.25
Loan Rate (Per Annum)	4%	4%	4%
Conversion Value (\$US per pound U as UF_6)	1.90	1.90	1.90
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	5.7	6.4	3.7
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	2.0	1.7	0.9
Near-Term Supply-Demand Ratio	2.9	3.7	2.9
Recent Uranium Sales:[3]			
Number of Transactions	13	9	6
Quantity of Material (Millions of pounds U_3O_8 equivalent)	9.4	19.2	1.0
Nuexco SWU Value: (\$US per SWU):			
at 0.3 tails assay (\$US per SWU)	69	73	78
US DOE SWU Prices: (\$US per SWU)			
USEC	117.00	119.00[4]	119.00[5]
AFC	153.00	153.00[6]	153.00[6]
Requirements	157.00	157.00[6]	157.00[6]
Incentive Price	90.00	90.00[7]	—
Market Value of Enriched UF_6[8]: (\$US per kgU as UF_6)			
2.5 w/o U_{235}	432	441	460
3.0 w/o U_{235}	551	563	591
3.5 w/o U_{235}	673	688	723
4.0 w/o U_{235}	796	814	858

---

[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/86.

[5] Effective since 10/1/85.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

November 1987 No. 231

R. GENE CLARK, *EDITOR* CHARLES B. LEWIS, *ASSISTANT EDITOR*

PRICING

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To Our Readers

* * *

Nuexco's George White (on the right), accompanied by his 21-year old son, Walker, is shown over southern California delivering the Nuexco Monthly Report to an out-of-the-way subscriber. Walker's new responsibilities, after his earlier stint designing and implementing Nuexco's database management system, reflect our increasing commitment to improved customer service.

The definition of the SWU Value has been clarified this month to delete references to specified origin and to bring the delivery period in line with the other Nuexco market values.

* * *

In the *Historical Market Data* section of the Report we have added year 1986 statistics which became available this month.

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CURRENT MARKET DATA

October 31, 1987	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$16.75**/lb. U_3O_8	5,735	1,985
US Premium	**$1.65**		
UF_6 VALUE	**$47.00**/kgU		
US Premium	**$3.10**		
CONVERSION VALUE	**$1.90**/lb. U as UF_6	330	660
SWU VALUE 0.3 tails assay:	**$69**/SWU	550	180
LOAN RATE	**4%**/annum	1,100	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**18.05**	**3.7**	**17**	**3**

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. **The US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed awillingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materialss delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of October 31, 1987)

The **Exchange Value** is **$16.75** per pound U_3O_8, up $0.10 since last month. US-origin uranium is commanding a **premium** (relative to the Exchange Value) of **$1.65** per pound U_3O_8 (down $0.45) in the form of concentrates, and $3.10 per kilogram U (down $1.15) in the form of UF_6. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **5,735,000** pounds U_3O_8 equivalent, down 700,000 pounds since last month. The corresponding figure for **active demand** is **1,985,000** pounds, up 260,000 pounds. The spot and near-term supply-demand ratio decreased to 2.9 to 1.

The Current Market Data section of this Report lists thirteen natural uranium sales, totaling 9.4 million pounds U_3O_8 equivalent.

The **Transaction Value** is $18.05 per pound U_3O_8, down $0.15 since last month. The calculation extends over a 3-month period and includes 17 transactions involving 3.7 million pounds equivalent U_3O_8.

The **UF_6 Value** is $47.00 per kilogram U in UF_6, up $0.25 since last month. Nine transactions involving UF_6 are reported, totaling approximately 2.3 million pounds equivalent U_3O_8.

The **Conversion Value** is $1.90 per pound U as UF_6, unchanged since last month. Active supply of secondary market conversion services totals 330 thousand pounds U as UF_6. Active demand totals 660 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is 4 percent per annum, unchanged since last month. Two loan transactions are reported.

* * *

The Exchange Value is $16.75 per pound U_3O_8, up $0.10 since last month. The announcement on October 4, 1987 of a Free Trade Agreement between the USA and Canada restored a measure of confidence to sellers of Canadian uranium, some of whom are active suppliers in the near-term market. If approved and implemented in its present form by the USA and Canada, the Free Trade Agreement will exempt Canadian uranium from US restrictions on the enrichment of non-US-origin uranium for use by US utilities, and it will exempt Canadian exports to the USA from the Canadian government's requirement that natural uranium be exported from Canada in the form of UF_6. Implementation of those conditions would be likely to reduce substantially or even or eliminate the price difference between US and Canadian-origin uranium in North America.

The Premium (relative to the Exchange Value) for US-origin U_3O_8 declined $0.45 this month, to $1.65 per pound U_3O_8. The announcement of the US-Canada trade agreement, and the October 8 issuance of a stay of the injunction prohibiting DOE from enriching non-US-origin uranium for US utilities, have made US utilities more reluctant to pay a premium under current market conditions.

Some sellers of US-origin concentrates have lowered their offering prices and others are considering doing so. Sellers' stocks of US uranium have grown over the past year as many US producers have stockpiled material in anticipation of a protected domestic market. Some sellers may now be considering liquidating those stocks on the chance that the premium for US-origin might disappear altogether. Nevertheless, a number of US producers remain optimistic that the Free Trade Agreement will not be ratified in its current form, and that the producers' lawsuit ultimately will be resolved in favor of the producers.

The *Current Market Data* section of this Report lists two spot or near-term U_3O_8 transactions, totaling approximately 650,000 pounds U_3O_8. Both of those transactions, however, were completed before the US-Canada Free Trade Agreement was announced early in October. One of those sales involved a significant quantity of natural uranium concentrates sold by a Canadian producer to a US utility at a price evaluated to be above last month's Exchange Value. In addition, two long-term U_3O_8 transactions are reported, involving approximately 7 million pounds U_3O_8 bought by a US utility from non-US suppliers. Both of these occurred earlier in the year.

The UF_6 Value is $47.00 per kgU as UF_6, up $0.25, reflecting a general strengthening of the market for non-US-origin material. The Premium (relative to the UF_6 Value) for US-origin UF_6 declined $1.15 to $3.10 per kgU. Nine spot and near-term UF_6 transactions are reported, involving approximately [illegible] million pounds U_3O_8 equivalent, of which approximately 850,000 pounds equivalent were of US origin. [illegible] the reported UF_6 transactions involved intermediaries, and most of those transactions took place before the early October announcements of the

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Appeals Court's stay of the injunction following from its earlier ruling against DOE, and the Free Trade Agreement with Canada.

In North America, at least four utilities are evaluating long-term supply proposals, and at least two other buyers have expressed interest in spot purchases; at this time US buyers are expressing interest in both US and non-US-origin uranium, and Canadian-origin has become the preferred non-US-origin since the announcement of the FTA. One large non-US buyer has expressed interest in making a spot purchase, and another European utility is evaluating long-term offers. Few European utilities have uncovered requirements for 1987 delivery at this time, and spot market buying activity is not expected to increase again until 1988.

* * *

The Loan Rate is 4 percent per annum, unchanged since last month. Two loan transactions are reported this month. Natural uranium stocks are sufficient to enable borrowers in the current market to obtain material of any origin as needed, provided that appropriate security for the loan can be provided.

* * *

The Conversion Value is 1.90 per pound U as UF_6, unchanged since last month. No secondary market conversion transactions are reported. As in recent months, conversion prices in the secondary market vary widely, depending on the origin and location of the concentrates delivered by the buyer and the UF_6 delivered by the seller. Conversion transactions involving US-origin material in the USA could take place at prices near the Conversion Value, however, non-US-origin conversion transactions in the USA may command prices at or above the current Conversion Value. Secondary conversion in Europe is generally much more expensive due to the small number of UF_6 and conversion sellers, and the higher price of primary conversion in equivalent US dollars, which affects secondary market prices. At current exchange rates, primary market conversion in Europe may cost about $4 per pound U as UF_6 ($9.00 per kgU), compared to approximately $2.75 per pound U as UF_6 ($6.00 per kgU) in North America.

ENRICHED URANIUM AND SWU

The SWU Value declined $4.00 this month to $69. In recent weeks several potential buyers have reported receiving offers below the $70 per SWU level for near-term delivery. During September, one US utility purchased a significant quantity of DOE-origin SWU at a price under $70, and at the end of October another US buyer appeared close to accepting an offer for DOE-origin SWU at a price near that level. Two key factors currently influence the secondary market:

1. The liquidation of a large quantity of FY1988 DOE SWU credits is expected in coming weeks at whatever price is necessary to complete their sale. DOE has offered a substantial quantity of DOE SWU through a competitive bid process on behalf of a US utility customer, and DOE has notified all of its present and former customers of the opportunity. While several utilities do have unfilled requirements in the 1987-1988 time period, Nuexco is not aware of any that are pressed to buy at this time, and buyers' bidding prices are likely to reflect that lack of urgency to buy. Bid prices also will depend on particular preferences for DOE-origin SWU credits compared with secondary market SWU of other origins.
2. Low-priced Soviet-origin SWU are having an increasing influence on the SWU Value. A number of spot sales of Techsnabexport (TSE)-origin SWU (bought either directly or indirectly through swaps) have occurred over the past 18 months, to European buyers and even to US utilities. The prices of these sales have been consistently below the SWU Value, but Nuexco has refrained from reflecting these in the SWU Value determination because the majority of the Western world's utilities have *de facto* policies prohibiting acquisition of TSE-origin SWU. Nevertheless, the lower prices being paid clearly are exerting downward pressure on secondary prices for DOE, Eurodif and Urenco-origin SWU. Furthermore, it appears that the political opposition to TSE-origin SWU may be weakening among some utilities in North America.

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MARKET UNCERTAINTIES COMPLICATE PROCUREMENT DECISIONS

The Proposed US-Canada Free Trade Agreement

On October 4, 1987, President Reagan announced his intention to enter into a trade agreement with Canada on January 3, 1988. With respect to uranium, the agreement (as presently structured) provides:

1. That Canadian-origin uranium be exempt from any restrictions on enrichment, beginning January 1, 1989. This essentially negates Section 161(v) of the Atomic Energy Act as it pertains to Canadian uranium;
2. That the uranium upgrading requirements of Canada's Atomic Energy Control Act will be eliminated with respect to uranium exported to the USA;
3. That both countries prohibit restrictions on imports or exports of uranium from the other country, including quantitative restrictions, taxes and minimum import or export prices.

If the Free Trade Agreement (FTA) were adopted with these provisions, Canadian-origin uranium would be considered to be the same as US-origin uranium for purposes of import into the USA, a situation effectively mooting both the on-going US Producers vs. DOE lawsuit and the import-limitation portion of the Senate Energy Committee's proposed legislation.

Recent Legislative and Judicial Developments in the USA

October brought two new developments in the US Producers vs. DOE lawsuit:

1. The Tenth Circuit Court of Appeals granted, until November 7, 1987, DOE's request for a further stay of Judge Carrigan's 1986 order barring the enrichment of non-US-origin feed for use by US utilities.
2. On October 19, DOE filed its petition for a *writ of certiorari* with the Supreme Court. The filing of that petition extends the stay until the Supreme Court denies the petition (in which event the case would be remanded to Judge Carrigan, who would be expected to enforce his original order), or the Supreme Court ultimately decides the case after granting the petition for *writ of certiorari*. The final decision in the case could be handed down as late as the end of 1988.

In addition, there continues to be strong opposition to the Senate Energy Committee's proposed legislation, both in the Senate and in the House of Representatives, despite the Committee's 13 to 2 approval of the bill. This opposition focuses primarily on the enrichment enterprise restructuring provisions of the bill. At this stage, even the bill's proponents appear to have concluded, however reluctantly, that its passage is unlikely.

Timetable for the Free Trade Agreement

Between October 5, 1987, and January 2, 1988, the Executive Branch and Congress will conduct informal consultations,with the House Ways and Means Committee, the Senate Finance Committee, and with other committees that have jurisdiction over matters that the FTA would affect. The President's negotiating authority expires on January 2, 1988, and the two countries have until that date to accomodate the views of their respective legislative branches, agree on the Free Trade Agreement's final language, and sign the Agreement.

Following signing of the Agreement by President Reagan and Prime Minister Mulroney, the Agreement becomes effective only upon passage by the US Congress and Canadian Parliament of implementing legislation. The President first must submit the final full text of the FTA to Congress, along with a draft of the necessary implementing legislation, a statement of any proposed administration action to implement the Agreement, and a detailed explanation of how the implementing legislation and proposed administrative action affect existing laws. In addition, the President must submit a statement explaining how the Agreement will serve US commercial interests and why the implementing bill is required and appropriate.

Such a package will likely be submitted to Congress soon after it reconvenes in January 1988, although it need not be submitted at that time. Once it has been submitted, no amendments can be made to the FTA text or to the implementing legislation, so it is essential that any changes or compromises be made during the period before formal submission to Congress. Congress has 60 legislative days after the FTA's formal submission to vote on the proposed implementing legislation. As the implementing bill will involve revenues, such as tariffs, it is likely that an additional 30-legislative-day period will be in effect, as specified under the 1978 "fast-track" provisions of the 1974 Trade Act.

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Conclusion

Despite the uncertainties introduced by the potential Free Trade Agreement, it is possible to make some general observations concerning its current and likely future market impact:

The present situation is likely to cause most US utility buyers to put intermediate or long-term purchases on hold while the situation resolves itself. Those few utilities actually needing to purchase material for short-term requirements in the interim are likely to buy non-US-origin material on the spot market, especially while DOE continues to enrich non-US-origin feed pending the Supreme Court review of the Producers' lawsuit. Most utilities have positioned themselves for the near-term to withstand a possible 100-percent embargo of non-US-origin feed, and are relieved at the possibility of their existing Canadian contracts and inventory being considered as usable as US-origin.

If the trade agreement is adopted before final resolution of the other issues, it follows that most US utilities would undertake a renewed round of long-term contracting with Canadian suppliers for the period after 1990, despite the appearance that Canada's current production capacity and existing commitments to non-US buyers preclude a substantial near-term increase in exports to the USA. Such a scenario also could stimulate increased long-term development of uranium properties in Canada.

Another potential effect of the Free Trade Agreement, if combined with the expected producer victory in the DOE lawsuit, could be a much diminished role for Australia's uranium sellers in the US market. While it is generally believed that a *total* embargo on uranium imports would be relatively short-lived, probably due to a strong negative reaction by US utilities that would, in turn, lead to Congressional action, a selective embargo that excluded Australian but allowed Canadian-origin probably would not provoke as strong a negative reaction from US utilities. Thus, Australian producers could suffer the greatest losses from this complicated series of events.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Oct 31, 1987)**	**Last Month (Sep 30, 1987)**	**12 Months Ago (Oct 31, 1986)**	**This Month (Oct 31, 1987)**	**Last Month (Sep 30, 1987)**	**12 Months Ago (Oct 31, 1986)**
Australia (dollar)	24.98	23.16	26.46	64.95	60.20	68.79
Belgium (comm. franc)	608.43	635.74	724.95	1,582	1,652	1,885
Canada (dollar)	22.07	21.83	23.61	57.39	56.75	61.38
EEC (ecu)	14.04	14.75	16.46	36.50	38.34	42.80
Finland (markka)	71.34	73.48	84.75	185.46	191.02	220.32
France (franc)	98.01	101.96	113.86	254.81	265.07	296.02
FRG (mark)	29.03	30.63	34.85	75.47	79.64	90.60
Italy (lira)	21,006	22,112	24,107	54,610	57,485	62,672
Japan (yen)	2,318	2,437	2,742	6,027	6,335	7,128
Netherlands (guilder)	32.69	34.48	39.43	84.98	89.64	102.52
South Africa (rand)	33.53	34.51	38.64	87.18	89.71	100.45
Spain (peseta)	1,952	2,026	2,334	5,075	5,268	6,068
Sweden (krona)	103.97	107.07	119.13	270.31	278.37	309.71
Switzerland (franc)	24.04	25.46	28.90	62.50	66.19	75.14
UK (pound)	9.76	10.22	12.12	25.37	26.58	31.51
US (dollar)	16.75	16.65	17.00	43.55	43.29	44.20

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Oct 31, 1987)**	**Last Month (Sep 30, 1987)**	**12 Months Ago (Oct 31, 1986)**	**This Month (Oct 31, 1987)**	**Last Month (Sep 30, 1987)**	**12 Months Ago (Oct 31, 1986)**
Australia (dollar)	26.92	25.31	26.85	69.99	65.81	69.[illegible]
Belgium (comm. franc)	655.65	694.92	735.61	1,705	1,807	1,912
Canada (dollar)	23.79	23.86	23.96	61.84	62.03	62.28
EEC (ecu)	15.13	16.12	16.80	39.33	41.91	43.68
Finland (markka)	76.87	80.32	85.99	199.85	208.81	233.56
France (franc)	405.62	111.45	115.54	274.58	289.75	300.38
FRG (mark)	31.28	33.49	35.36	81.33	87.06	91.94
Italy (lira)	22,636	24,170	24,461	58,849	62,837	63,594
Japan (yen)	2,498	2,664	2,782	6,495	6,925	7,223
Netherlands (guilder)	35.23	37.69	40.01	91.58	97.98	104.03
South Africa (rand)	36.14	37.72	39.20	93.95	98.06	101.92
Spain (peseta)	2,104	2,215	2,369	5,469	5,758	6,158
Sweden (krona)	112.04	117.04	120.88	291.28	304.28	314.27
Switzerland (franc)	25.91	27.83	29.33	67.35	68.10	76.24
UK (pound)	10.52	11.18	12.30	27.34	29.05	31.97
US (dollar)	18.05	18.20	17.25	46.93	47.32	44.85

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month indicated.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (Oct 31, 1987)**	**Last Month (Sep 30, 1987)**	**12 Months Ago (Oct 31, 1986)**	**This Month (Oct 31, 1987)**	**Last Month (Sep 30, 1987)**	**12 Months Ago (Oct 31, 1986)**
Australia (dollar)	2.83	2.64	2.96	6.25	5.83	6.52
Belgium (comm. franc)	69.02	72.55	81.02	152.15	159.94	178.63
Canada (dollar)	2.50	2.49	2.64	5.52	5.49	5.82
EEC (ecu)	1.59	1.68	1.84	3.51	3.71	4.06
Finland (markka)	8.09	8.38	9.47	17.84	18.49	20.88
France (franc)	11.12	11.64	12.73	24.51	25.65	28.06
FRG (mark)	3.29	3.50	3.90	7.26	7.71	8.59
Italy (lira)	2,383	2,523	2,694	5,253	5,563	5,940
Japan (yen)	262.98	278.06	306.45	579.76	613.02	675.61
Netherlands (guilder)	3.71	3.93	4.41	8.17	8.67	9.72
South Africa (rand)	3.80	3.94	4.32	8.39	8.68	9.52
Spain (peseta)	221.45	231.23	260.88	488.20	509.77	575.14
Sweden (krona)	11.79	12.22	13.31	26.00	26.94	29.35
Switzerland (franc)	2.73	2.91	3.23	6.01	6.40	7.12
UK (pound)	1.11	1.17	1.35	2.44	2.57	2.99
US (dollar)	1.90	1.90	1.90	4.19	4.19	4.19

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value at 0.30% tails assay (Oct 31, 1987)**	**UF_6 Value per kg.U in UF_6 This Month (Oct 31, 1987)**	**UF_6 Value per kg.U in UF_6 Last Month (Sep 30, 1987)**
Australia (dollar)	102.91	70.09	65.02
Belgium (comm. franc)	2,506	1,707	1,785
Canada (dollar)	90.93	61.93	61.28
EEC (ecu)	57.84	39.39	41.41
Finland (markka)	293.87	200.17	206.31
France (franc)	403.74	275.01	286.28
FRG (mark)	119.58	81.45	86.01
Italy (lira)	86,531	58,942	62,085
Japan (yen)	9,550	6,505	6,842
Netherlands (guilder)	134.66	91.72	96.81
South Africa (rand)	138.14	94.09	96.89
Spain (peseta)	8,042	5,478	5,689
Sweden (krona)	428.31	291.74	300.64
Switzerland (franc)	99.04	67.46	71.48
UK (pound)	40.20	27.38	28.70
US (dollar)	69.00	47.00	46.75

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month indicated.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4170	1987	101-300	98—102	Producer	Intermediary	UF_6
4171	1987	less than 50	98—102	Intermediary	Utility	US-Origin UF_6
4172	1988	301-600	93—97	Producer	R[3]	UF_6
4176	1987	301-600	R[3]	Intermediary	Utility	UF_6
4177	1987	301-600	103—107	Utility	Intermediary	US-Origin
4178	1987	101-300	98—102	Producer	Intermediary	US-origin UF_6
4179	1989	101-300	98—102	Producer	R[3]	UF_6
4180	1989-98	3,001-5,000	See Comments	Producer	Utility	Market-related
4181	1989-98	3,001-5,000	See Comments	Producer	Utility	UF_6, Mkt. Rel.
4184	1987-88	101-300	98—102	Producer	Utility	
4189	1987	50-100	R[3]	Producer	Intermediary	US-Origin UF_6
4190	1988	50-100	R[3]	Producer	Intermediary	US-Origin UF_6
4194	1988	301-600	103—107	Intermediary	Utility	UF_6

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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Loan Transactions

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Loan Rate)	Lender	Borrower	Remarks
4186	1987	101-300	R[4]	Utility	Intermediary	UF_6
4187	1987	101-300	R[4]	Utility	Intermediary	UF_6

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[3] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

[4] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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CURRENT MARKET DATA

URANIUM SUPPLY
(October 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1002	270	—	
87-1014A*	275	—	UF_6
87-1022	40	—	
87-1023	500	500 per year	1987-90
87-1053	100	400 per year	1989 on
87-1055*	200	300 per year	1988-93
87-1091	1,000	1,000 per year	UF_6
87-1097	500	—	
87-1109	50	250 per year	1990 on
87-1120	1,000	—	
87-1123*	400	—	
87-1124	500	500 per year	1988 on
87-1130	750	—	
87-1142*	150	—	
87-1001	—	400 per year	1989 on
87-1005	—	400 per year	1988-95
TOTAL:	5,735		
INACTIVE			
87-1017	1,000	—	
87-1059	120	—	UF_6
87-1061	780	800 per year	UF_6, 1988 on
87-1130*	850	—	UF_6
87-1135*	500	—	
87-1019	—	600 per year	1988-91
87-1025	—	250 per year	1988 on
TOTAL:	3,250		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1084C.

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URANIUM DEMAND
(October 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8)		Remarks
	Spot or Near-term[2]	Intermediate or Long-term	
Inquiries to Purchase:			
ACTIVE			
87-1007*	150	—	
87-1030*	175	—	
87-1107	450	1,225	1990-92
87-1116	60	—	UF_6
87-1121	650	650 per year	1988-96
87-1124*	125	—	UF_6
87-1138*	175	—	UF_6
87-1140	200	—	
87-1013	—	1,200 per year	1990-95
87-1021	—	200 per year	1992 on
87-1108	—	200 per year	1991-2000
87-1134*	—	260	1989
TOTAL:	1,985		
INACTIVE			
87-1040	300	300	1989
87-1048	50	—	
87-1049	—	700 per year	1989-96
87-1073	800	—	UF_6
87-1114	525	—	
87-1125	390	—	
TOTAL:	2,065		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1057, 1078, 1113.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(October 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1064	600	—	
87-1119	500	—	
TOTAL:	1,100		
INACTIVE			
87-1012	2,000	—	
87-1031	1,000	—	
87-1033	1,000	—	
87-1071	1,000	—	UF_6
TOTAL:	5,000		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 1098.

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CONVERSION SUPPLY AND DEMAND
(October 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale: ACTIVE			
87-1122	330	—	
TOTAL:	330	750	
INACTIVE			
87-1008	750	750	
TOTAL:	750		
Inquiries to Purchase: ACTIVE			
87-1072	440	—	
87-1132	220	—	
TOTAL:	660		
INACTIVE			
87-1009*	220	—	
TOTAL:	220		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 1084C, 1131.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(October 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1058*	150	—	1987
87-1068	100	—	1988
87-1096*	300	—	1988
TOTAL:	550		
INACTIVE			
87-1004	55	—	1987
87-1059	25	—	1987
87-1128	300	—	1987
87-1130*	150	—	1989
TOTAL:	530		
Inquiries to Purchase:			
ACTIVE			
87-1100	55	—	1988
87-1116*	100	—	1989
87-1139*	25	—	1989
TOTAL:	180		
INACTIVE			
87-1065	150	—	1988
TOTAL:	150		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: None.

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RECLAMATION AND STABILIZATION OF URANIUM TAILINGS SITES IN THE USA

Introduction

Until the early 1970s, there were virtually no regulations covering decommissioning and reclamation procedures for uranium production facilities in the USA. Early uranium production projects focused on the economics of uranium (U_3O_8) recovery, and mining was carried out with little regard for the disposal of mined waste rock, especially in open-pit mines where large volumes of material were handled. Mills and tailings ponds usually were placed for convenience to the ore source, as well as for convenient topography and adequate fresh water supply. The adverse effects and consequences of radioactivity on surface and subsurface (ground water) environments, especially long-term effects, were poorly understood.

As technology advanced and the uranium industry's experience increased, the government and the producers increasingly became aware of the environmental problems caused by uranium production activities, especially mill tailings. Studies began in the early 1960s identified the buildup of radioactive elements, including radium, radon and radon daughter products, as potential health and environmental hazards occurring in tailings and in surrounding contaminated areas. Studies by government agencies and private industry have since documented that uranium mining can cause a significant radiological and chemical threat to public health and the environment.

Because of the increased awareness of health hazards associated with uranium mining and milling, government and industry-sponsored regulations now affect virtually all US uranium projects, past and present. Even though regulations may vary somewhat from state to state, the primary concern is the same — containment and stabilization of mill tailings, and preventing their off-site dispersal. Mine reclamation and mill decommissioning are considered less critical issues, although these also are covered by regulations.

Recently-designed projects must operate within the limits of new regulations. One of the most important concerns is

Figure 1. Energy Fuels' White Mesa Uranium Mill, Blanding, Utah.
**All photos courtesy of Energy Fuels Nuclear, Inc.*

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preventing the leakage of tailings solutions into groundwater aquifers. (Figure 2 shows lining material being installed in a tailings containment basin.) All recent projects are designed to minimize downward seepage and to allow prompt stabilization of tailings piles, as well as to optimize cleanup of surface and underground installations when the project closes down. Through careful site selection, design and construction of tailings containment basins, mine operators can achieve virtually total containment of solid waste material and the regulated release of excess liquid waste. Designing these features into newer projects has lessened the negative economic impact of some requirements.

Background

Government support for the US uranium production industry extended from 1942 through 1970; the first four years on behalf of the US Army's Manhattan Engineering District and the remaining period under jurisdiction of the Atomic Energy Commission (AEC). The government's procurement program offered guaranteed prices as well as bonus payments for uranium ore and for U_3O_8. The program expanded rapidly in the 1950s, with literally hundreds of privately-owned and operated mines coming into production throughout 12 western states. By 1960 the industry had become more stable, with 26 privately-owned and operated mills in production. During the period 1948 to 1970, the AEC purchased almost 350 million pounds of U_3O_8 from producers in the USA, more than 80 percent of total production for the period. These purchases required the processing of over 80 million tons of ore, most of which was then deposited as tailings.

Figure 2. Installing synthetic lining material in tailings containment basin, White Mesa Mill.

The AEC uranium procurement contracts covered only the purchase of uranium — the contracts had no provisions for reclamation and decommissioning of mine and mill facilities or for tailings stabilization. However, after government and private sources recognized the potential hazards of tailings piles, remedial action was considered. Congress enacted the first remedial action law in 1972. Subsequent laws (and currently proposed bills) provide for remedial action on all conventional uranium mill tailings piles in the USA. Uranium producers today, faced with large expenditures for reclamation, take the position that not enough of the cost of reclamation is borne by the government, whose demand for uranium in the early days of the industry led to much of the current tailings disposal situation.

Characteristics of Uranium Mill Tailings

Uranium tailings management combines many of the factors found in other non-ferrous mining operations with a radiological component not normally found elsewhere. As a result, efforts to establish regulatory procedures and standards have had to decide whether to treat uranium tailings as a special type of low-level nuclear waste product or as a somewhat unique type of mining waste. The primary constituents in uranium tailings that are a threat to the environment vary widely depending on specific types of ore, but include molybdenum, selenium, vanadium and arsenic — some of the same elements and compounds that are found in many other mining operations.

Newly-milled uranium is not highly radioactive. Most of the radiation in the ore results from the decay over time of uranium radionuclides from the U-238 series, many of which are left in the tailings material rather than in the extracted uranium. Radon-222 and its immediate decay ("daughter") products are, for example, alpha emitters present in uranium tailings and are considered dangerous if inhaled. Because radon is an inert gas, radon-222 is quite mobile and can leave the confines of its uranium ore host.

The pathways by which these hazardous elements or compounds can enter the environment may be quite variable worldwide. However, because the great majority or uranium operations in the USA occur in arid areas of the west or southwest, the dominant processes or pathways are wind erosion, flash flooding, or seepage into groundwater aquifers. (Figures 3 and 4 show fences erected in an effort to prevent movement of windblown tailings material.)

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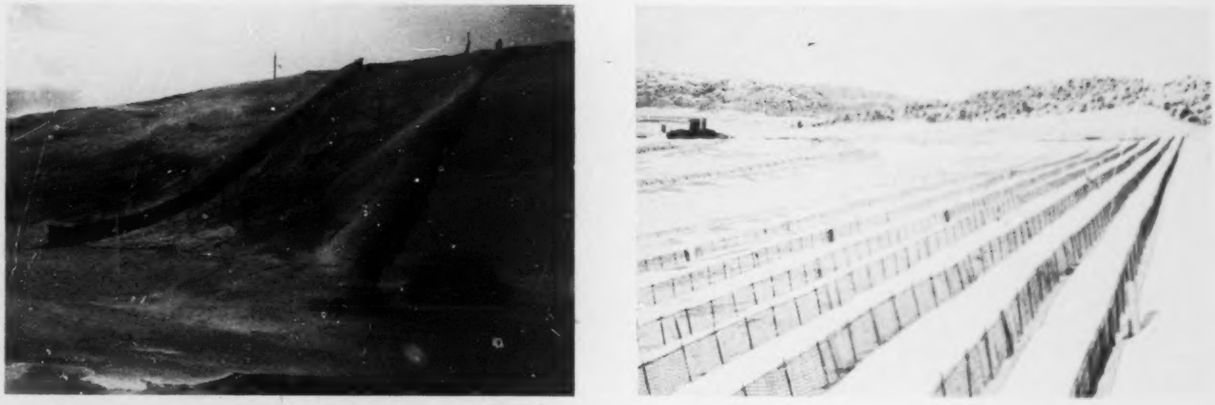

Figures 3,4. Fences erected to inhibit movement of wind-blown tailings material.

Fortunately, many mill sites (and therefore tailings sites) are located in sparsely-populated areas, and their tailings materials have not posed much of a threat to local populations. In the past, however, some tailings were used as earthfill material in residential construction, presenting unusual and more costly reclamation problems. The highest priority tailings reclamation sites in the USA are not the largest, but are those in close proximity to population centers.

Regulatory Requirements

All US uranium production sites currently are subject to certain regulations, although requirements may differ by county, state and degree of severity. Regulations must be flexible enough to allow their site-specific adaptation, because each project operates (or operated) under different circumstances. Since mill tailings are the main area of concern, design of regulations has focused on that problem, with the necessary modifications for other production methods where applicable, such as solution mining. Regulations that govern tailings generated from by-product uranium production projects, such as are located in the phosphate region of the southeast USA, are equivalent to those pertaining to less hazardous waste materials.

The regulations for conventional production centers cover mine sites and vicinity properties, tailings reclamation, and mill decommissioning. Regulatory responsibility falls under the following government branches:

1. Mine Sites — for active mines, the mine operator is responsible; for abandoned mines, the State has jurisdiction.
2. Mill tailings — primary responsibility is assumed by the NRC, using guidelines established by the Environmental Protection Agency (EPA).
3. Vicinity Properties — under UMTRCA, the Department of Energy (DOE) provides funds and has primary responsibility, with consultation by the Nuclear Regulatory Commission (NRC).
4. Mill decommissioning — the NRC is responsible, with state concurrence.

The Uranium Mill Tailings Radiation Control Act (UMTRCA)

The UMTRCA was not the first uranium mill tailings-related legislation. The first legislation directed toward tailings disposal (Public Law 92-314) was enacted on June 16, 1972. Title II of this bill provided for removal of uranium tailings from private premises and was limited in scope to the cleanup of private properties in the area of Grand Junction, Colorado.

However, passage of the UMTRCA (P.L. 95-604) in November 1978 represented a much more comprehensive approach to tailings management and is the most complete and important law to date covering uranium tailings reclamation and stabilization. The basic intent of the law, under provisions of Title I, is to provide for remedial action work at the 24 inactive tailings sites created during the AEC procurement program (Table1). However, provisions of Title II extended the law's regulatory authority to include remedial actions on active uranium and thorium tailings sites. Also, there are about 8,000 vicinity properties (properties outside the mill property that are contaminated with tailings) that

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Table 1

INACTIVE URANIUM PROCESSING SITES — UMTRA PROGRAM

State	Processing site	Quantity of Tailings (Million tons)[1]	Designated Vicinity Properties	Health Hazard	Planned Completion Date[2]
Arizona	Monument Valley[3]	1.10	17	Low	1991
	Tuba City[3]	0.80	8	Medium	1989
Colorado	Durango	1.55	137	High	1989
	Grand Junction	1.90	6905	High	1991
	Gunnison	0.54	14	High	1990
	Maybell	2.60	**	Low	1991
	Naturita	0.34	60	Medium	1991
	New Rifle	2.70	384	High	1991
	Old Rifle	0.35	—	High	1991
	Slick Rock	0.04	4	Low	1992
	Slick Rock	0.35	—	Low	1992
Idaho	Lowman	0.09	17	Low	1992
New Mexico	Ambrosia Lake	2.60	**	Medium	1989
	Shiprock[3]	1.50	17	High	1986
North Dakota	Belfield	0.05	11	Low	1992
	Bowman	0.07	3	Low	1992
Oregon	Lakeview	0.13	4	Medium	1988
Pennsylvania	Canonsburg	0.41	111	High	1985
Texas	Falls City	2.50	20	Medium	1991
Utah	Green River	0.12	29	Low	1992
	Mexican Hat[3]	2.20	21	Medium	1991
	Salt Lake City	1.88	127	High	1987
Wyoming	Spook	0.19	1	Low	1992
	Riverton	0.90	50	High	1989
	TOTAL:	24.91			

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[1] Based on 1986 DOE data.
[2] Based on UMTRCA master schedule (8/86)
[3] Site located on Navajo tribal lands.
**No vicinity properties involved.

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will be reclaimed along with properties listed under Title I and Title II.

Under Title I of the UMTRCA, DOE created and assumed overall responsibility for the Uranium Mill Tailings Remedial Action Program (UMTRAP), the EPA established the standards for the required remedial action work, and the NRC reviews and enforces remedial action plans, and issues a license for surveillance and maintenance of the stabilized site.

In April 1983, DOE and the NRC accepted the EPA's newly-defined standards. The primary standards established for UMTRAP call for:

1. A stable tailings environment for up to 1,000 years, to the extent reasonably achievable and, in all cases, for a minimum of 200 years.

2. Radon emissions (Radon-222) are not to exceed 20 picocuries per square meter per second, and any increase in the annual average concentration of radon in the air at or above any location may not exceed 0.5 picocuries per liter.

3. Existing federal and state regulations governing water (surface and subsurface) protection measures will be used on a site-specific basis. (Note: The Tenth Circuit Court of Appeals remanded the water considerations, requiring the EPA to establish general application standards. Until this is done, DOE has applied an interim plan satisfactory to NRC and state agencies.)

Title I of the UMTRA program was originally scheduled for completion within seven years after the establishment of EPA standards, or March 1990. Due to budget restraints, however, it may be extended to 1993. Figure 5 shows the locations of 23 UMTRAP inactive tailings sites located in the western USA. Not shown is the 24th site, which is located at Canonsburg, Pennsylvania, where the remedial action program was initiated in October 1983.

DOE has full responsibility for the UMTRA program and each state and Indian tribe with abandoned tailings on their lands participates through a Cooperative Agreement with DOE. This agreement establishes rules and procedures for conducting remedial action work on each site. Overall project costs have been estimated at $940 million, of which participating states pay 10 percent and the federal government pays 90 percent (the federal government pays total costs for work on all Indian lands).

Actions Taken Under the Remedial Action Program

The earlier 1972 legislation (P.L. 92-314) provided for removal of uranium tailings from private premises (vicinity properties) in the area of Grand Junction, Colorado. About 2.2 million tons of uranium mill tailings from the AEC buying program are located near Grand Junction, of which approximately 300,000 tons were removed from the tailings pile for use in local construction or landfill projects prior to 1966. The law provided financial assistance to the State of Colorado for the removal of tailings from the public sites; stabilization of the tailings pile was not included. The US government will pay about 75 percent of the estimated $25 million cost, and the state will pay the remaining 25 percent. Although the program is still in progress, it presently falls under provisions of the UMTRCA, and now includes, at additional cost, the tailings pile.

Since 1979, the UMTRA program has undertaken work on six of the 24 inactive sites. A brief description of activities on those sites is listed below:

Canonsburg, Pennsylvania — The Standard Chemical Company produced radium on the 38-acre site from 1911 to 1922; from 1942 to 1957, Vitro Corporation of America reprocessed the tailings to recover radium and uranium salts. Remedial action work began in October 1983. The contractors buried contaminated structures in 400,000 tons of tailings which were stabilized in place, and about 160 vicinity properties were decontaminated. The work was completed in December 1985 at a reported cost of approximately $30 million.

Salt Lake City, Utah — The Vitro Corporation of America produced uranium on the 128-acre site from 1951 through 1964, and vanadium from 1964 to 1968. The mill was dismantled in 1970. Remedial action work began in 1985 and final cleanup is still being completed. All contaminated structures and tailings have been relocated for burial at a carefully prepared site about 85 miles west of Salt Lake City. The work program included over 120 vicinity properties and costs approximately $50 million.

Shiprock, New Mexico — Over two million tons of uranium tailings were created by Kerr-McGee Oil Industries, Inc. from 1954 to 1963, and by the Vanadium Corporation of America from 1963 to 1968. The 230-acre site is situated on land controlled by the Navajo Nation. Contractors stabilized the site's 1.5 million tons (1.3 million cubic yards) of contaminated materials with a six-foot cover of clay, followed by two feet of rock covering, during an 18-month work period, which finished in October 1984. The cleanup included removing windblown tailings from 16 vicinity

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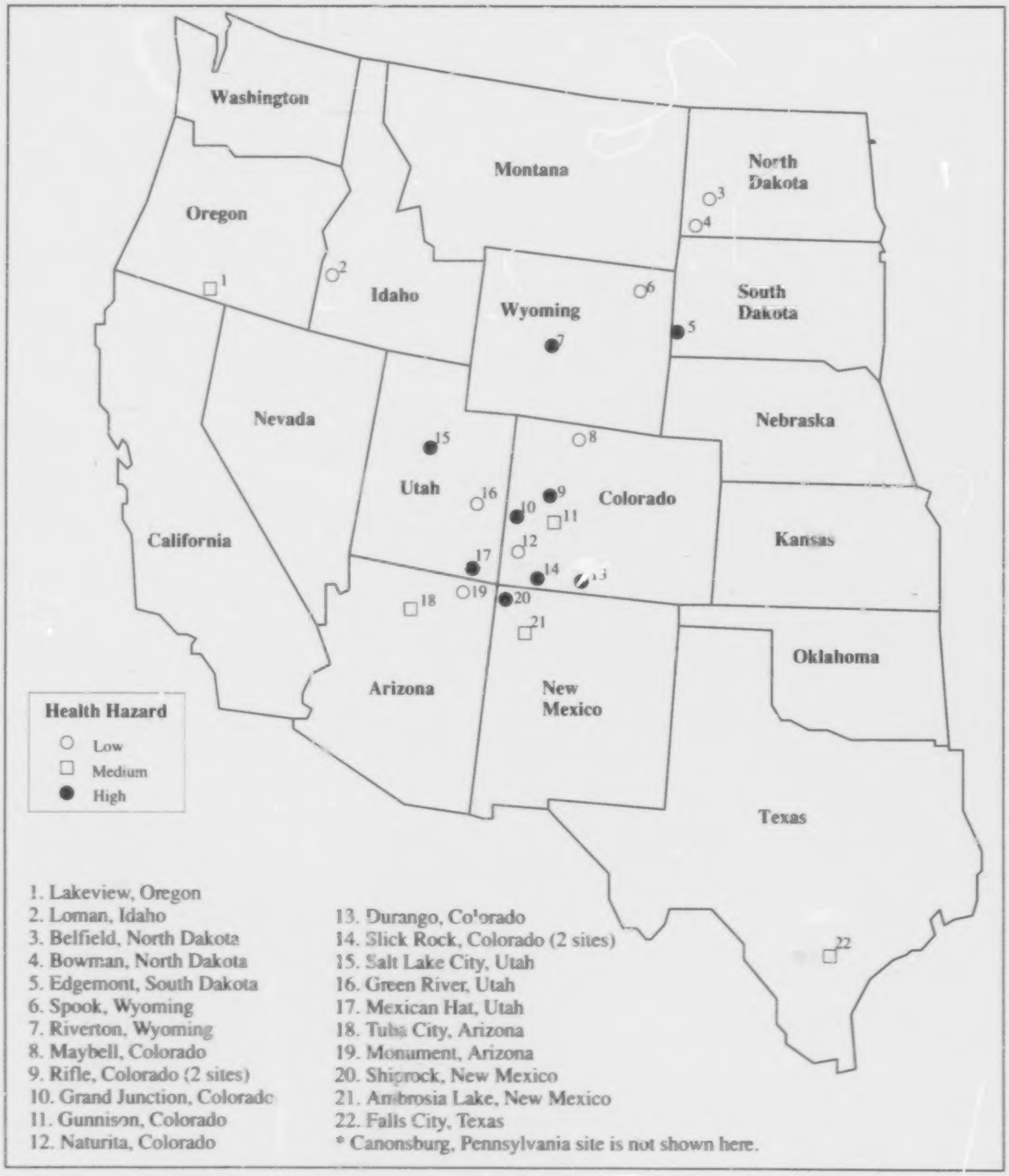
Washington
Montana
North Dakota
Oregon
Idaho
Wyoming
South Dakota
Nevada
Utah
Colorado
Nebraska
California
Kansas
Arizona
New Mexico
Oklahoma
Texas
Health Hazard
○ Low
☐ Medium
● High
1. Lakeview, Oregon
2. Loman, Idaho
3. Belfield, North Dakota
4. Bowman, North Dakota
5. Edgemont, South Dakota
6. Spook, Wyoming
7. Riverton, Wyoming
8. Maybell, Colorado
9. Rifle, Colorado (2 sites)
10. Grand Junction, Colorado
11. Gunnison, Colorado
12. Naturita, Colorado
13. Durango, Colorado
14. Slick Rock, Colorado (2 sites)
15. Salt Lake City, Utah
16. Green River, Utah
17. Mexican Hat, Utah
18. Tuba City, Arizona
19. Monument, Arizona
20. Shiprock, New Mexico
21. Ambrosia Lake, New Mexico
22. Falls City, Texas
* Canonsburg, Pennsylvania site is not shown here.

Figure 5. Locations of UMTRAP Inactive Tailings Sites.

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properties. The $14.7 million cost of the reclamation has been paid entirely by DOE.

Lakeview, Oregon — The Lakeview Mining Company initiated uranium milling in 1958. Milling continued on an irregular schedule under five or six different owners until 1968, when Atlantic Richfield purchased the operation. Altogether, about 400,000 tons of tailings had accumulated on 30 acres of the 258-acre site. Atlantic Richfield decontaminated the mill site in 1974 according to then-existing standards. Remedial action will entail relocating and burial of the tailings and other contaminated materials at a site six miles northeast of the mill site. The cleanup program includes seven vicinity properties. The program began in June 1986 and is scheduled for completion in late 1987.

Durango, Colorado — The mill was built in 1942 to supply vanadium to the US government. The United States Vanadium Corporation reworked the tailings for uranium, and processed newly-mined uranium/vanadium ores from 1943 to 1946 and from 1949 to 1963. The site covers 127 acres and contains two tailings piles. The largest pile covers seven acres and contains about 1,230,000 tons; the small pile contains about 325,000 tons on three acres. Ranchers Exploration and Development Corporation (since acquired by Hecla Mining Company) purchased the site in 1977. All contaminated materials at the site, and from 100 vicinity property locations and 50 windblown acres, will be relocated and buried at a site 3.5 miles from Durango. The remedial action program began in 1986 and is scheduled for completion by 1990, at a cost of approximately $25 million.

Tuba City, Arizona — In 1956, the Rare Metals Corporation of America built a uranium mill on a 105-acre site located on land controlled by the Navajo Nation. The mill operated until 1966 when full control of the site reverted to the Navajo Nation. About 800,000 tons of tailings are located on 22 acres. All contaminated buildings and materials will be buried adjacent to or in the tailings. Phase 1 (demolition of buildings) was completed in 1986; Phase 2 will begin in late 1987 and is scheduled for completion by 1989.

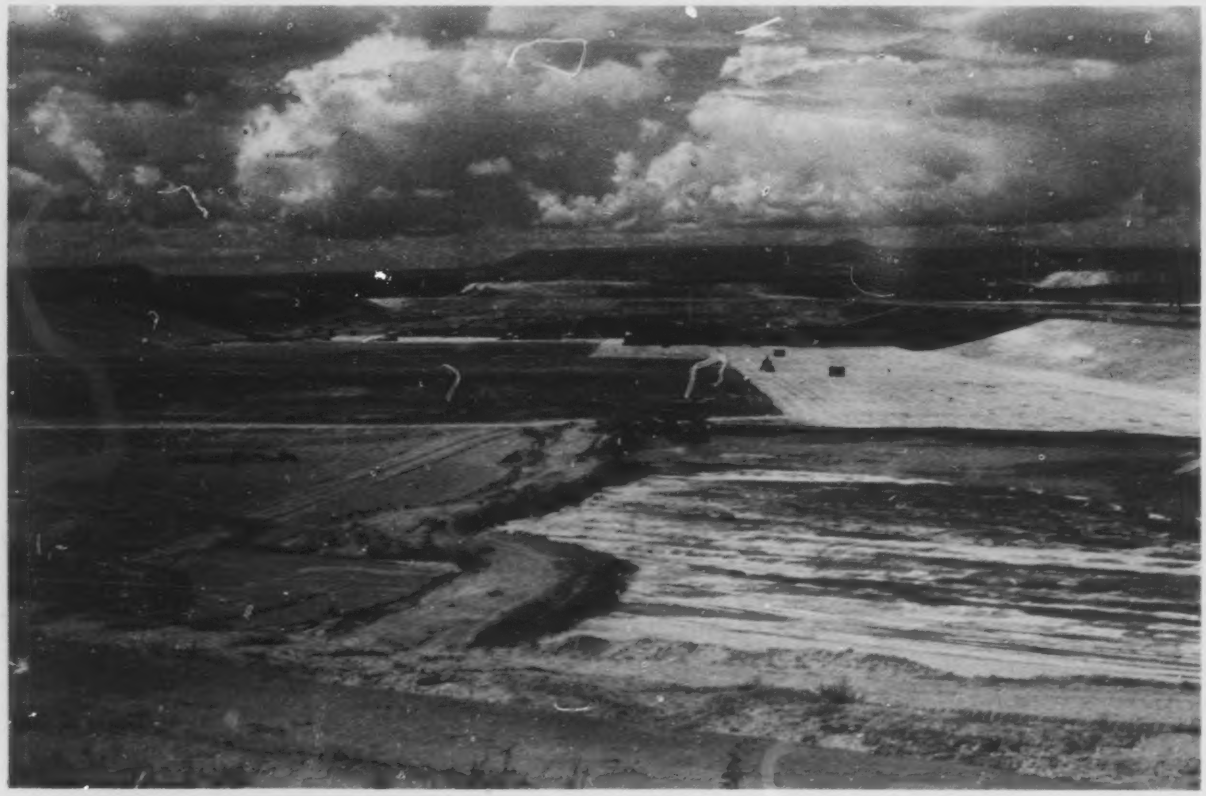

Figure 6. Tailings cell no. 3, White Mesa Mill.

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Work is scheduled to begin soon at the Riverton, Wyoming site of Susquehanna Western, which generated some 1.8 million cubic yards of tailings. Contractor for the project is Landmark Reclamation, a subsidiary of Energy Fuels Nuclear and Umetco Minerals. Tailings material will be relocated to an existing tailings impoundment approximately 55 miles away. Total cost for the project is expected to be over $20 million.

After the Remedial Action Program was underway, problems began to arise concerning the identification of, and payment for tailings material that was created under the early government procurement program. Public Law 96-540 (December 1980), Section 213, provided for the Secretary of Energy to develop a plan for assistance in the stabilization and management of uranium mill tailings accumulated under the AEC procurement program and which are now commingled with tailings from commercial-related operations. There are 13 sites with comingled tailings (Table 2).

As a result of the study conducted for the Secretary of Energy, DOE included the 13 sites with comingled tailings in the category of "licensed" mills and, bringing them under the provisions of UMTRCA requirements outlined in Title II. Thus, the 13 sites with comingled tailings, as well as sites with commercial-only tailings, are in the same category. However, Title II did not provide a method for uranium producers to finance reclamation and remedial action of tailings categorized as comingled or commercial. Due to the retroactive nature of the UMTRCA, producers and mill operators feel that the government, together with utility companies, should pay part of the cost of meeting UMTRCA requirements.

Draft Legislation

In order to provide partial government funding of comingled tailings reclamation, Senator Pete V. Domenici (R-New Mexico) has recently introduced Draft Bill S.1100 in the US Congress.

The bill, entitled Uranium Revitalization, Tailings Reclamation and Enrichment Act of 1987, provides, in part, for financing of all reclamation and remedial action that may take place on all active mill sites. According to the latest version of the bill, financing is to be:

"... shared on an approximately equal basis by owners or licensees of active uranium mills, the Federal government, and the owners or licensees of civilian nuclear power reactors, with support from the states in which the active sites are located."

Title II of Domenici's bill calls for the establishment of a Uranium Mill Tailings Fund, to be used to pay for UMTRCA-required reclamation at qualified mill sites. A mill site would be "qualified" if it is listed in Title II of the bill and if the owner or licensee agrees to participate in the draft bill's funding program. The Fund would have three groups of contributors — the mill site owners or licensees, DOE, and utility company licensees of civilian power reactors.

Mill owners or licensees would have to pay a flat fee of $2 million per site for tailings reclamation, as well as $500,000 for any mill decommissioning. In addition, producrs would be assessed a fee of $1.00 per dry ton of tailings produced for commercial sale after the bill's effective date, if it is passed into law. The federal government would pay $300 million into the Fund, and civilian reactor licensees would pay $22.00 per kgU contained in the reactor fuel elements loaded into their reactors in the years 1989 to 1993. Upon passage of the Draft Bill, the Treasury Department would establish the Uranium Mill Tailings Fund, with payments to mill owners beginning shortly after.

Reimbursements paid to mill owners or licensees would be limited to payments of less than $4.50 per dry ton of tailings, and any payment into the fund by a mill owner of more than one-third of the total site reclamation cost would be refunded to that contributor. Reclamation of tailings generated after the proposed bill would take effect, would not be covered under the program, and operators costs would be calculated on a site-by-site basis.

The bill lists 26 active sites that qualify for reimbursement of remedial action work, including the 13 sites with commingled tailings and the 13 sites with commercial-related tailings. Combined, the 26 sites contain an estimated 194 million tons of tailings. Total reclamation costs for the project are uncertain because technical evaluation is still in progress. There is no set time schedule for project startup for the same reason. Although the draft bill has passed through the Senate Energy Committee, strong opposition exists both in the Senate and House of Representatives, and many observers believe that the bill's chances of passage are not good.

Conclusion

Since the early 1970s, solving the problems of how to safely stabilize and handle uranium tailings from both the early AEC procurement program and from commercial

Table 2

ACTIVE URANIUM MILL SITES IN THE USA INCLUDED IN THE PROVISIONS OF UMTRCA

State	Mill	Company	Location	Quantity of Tailings (1,000 tons)	Status
Mills with Commercial-related tailings only:					
Colorado	Maybell[1]	UMETCO	Maybell	2,000	Inactive
New Mexico	Churchrock	UNC Resources	Churchrock	3,500	D/R[2] in progress
	L-Bar	Kennecott	Seboyeta	2,100	D/R in progress
Texas	Panna Maria	Chevron Resources	Hobson	4,600	Operating
	Conquista[3]	Conoco/Pioneer Nuc.	Falls City	8,800	D/R, final stage
	Felder	Exxon Nuclear Co.	Three Rivers	400	D/R, final stage
Utah	Lisbon	Rio Algom Corp.	La Sal	3,000	Operating
	White Mesa	Energy Fuels, UMETCO	Blanding	1,900	Operating
Washington	Sherwood	Western Nuclear	Wellpinit	2,900	Standby[4]
Wyoming	Highland	Exxon Nuclear Co.	Douglas	7,200	D/R, final stage
	Bear Creek	Rocky Mtn. Energy	Douglas	5,000	D/R, in progress
	Shirley Basin	Pathfinder Mines	Shirley Basin	6,300	Operating
	Sweetwater	Minerals Exploration	Red Desert	1,000	Standby
			TOTAL:	48,700	
Mills with comingled Tailings - AEC and commercial-related:					
Colorado	Cotter	Cotter Corp.	Canon City	2,200	Standby
	Uravan	UMETCO	Uravan	10,300	Standby
New Mexico	Bluewater	ARCO	Bluewater	23,600	Inactive[5]
	Quivira	Quivira Mining Co.	Ambrosia Lake	33,000	Standby
	Homestake	Homestake Mining Co.	Grants	21,800	Operating
South Dakota	Edgemont[6]	Tennessee Valley Auth.	Edgemont	2,000	D/R, in progress
Utah	Atlas	Atlas Minerals Corp.	Moab	10,500	Standby
Washington	Dawn	Newmont Mining Co.	Ford	3,000	Standby
Wyoming	ANC	American Nuclear	Gas Hills	5,900	Standby
	Lucky Mc	Pathfinder Mines	Gas Hills	9,500	Operating
	Petrotomics	Texaco	Shirley Basin	6,300	D/R, final stage
	East Gas Hills	UMETCO	Gas Hills	9,200	Standby
	Split Rock	Western Nuclear, Inc.	Jeffrey City	7,700	Inactive
			TOTAL:	145,000	

---

[1] UMETCO's heap leach site, not to be confused with tailings site No. 8 on Figure 5.

[2] D/R = decommissioning of mill and reclamation of mill area, including tailings pile and aquifer evaluation, any one of which may be in various stages of completion.

[3] Conquista decommissioning and reclamation complete except for a portion of the tailings pile used as a state low-level waste depository.

[4] Standby refers to mills that may operate in the future.

[5] Inactive refers to mills that will not operate again and are considered for decommissioning.

[6] Mill decommissioning and tailings removal for burial in progress by TVA.

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uranium mining and milling has depended on several legislative actions. The most comprehensive of these is the UMTRCA, enacted in 1972, which has regulations covering the now inactive tailings sites as well as active ones.

Under the UMTRCA, and its remedial action program (UMTRAP), 24 inactive tailings sites, including over 8,000 vicinity properties that have since become contaminated with tailings material, are scheduled for cleanup, most of the cost of which is being paid for by the federal government. Separate but related regulations cover mill sites and tailings areas considered active, some of which have tailings generated earlier during the era of government procurement and which are comingled with commercially-produced tailings.

Many uranium producers in the USA feel that they should not be asked to pay the considerable sums necessary for tailings stabilization, when at the time many of the tailings were generated few or no regulations existed controlling tailings disposal. At present, only part of the expense for tailings reclamation is paid by the federal and state governments, while the bulk of it must be paid by the uranium producers. Senator Pete V. Domenici of New Mexico has sponsored several draft bills in Congress that deal with, among several other nuclear industry-related issues, tailings disposal and reclamation. Although the latest version of this proposed legislation faces considerable opposition in Congress, its passage could lead to a new fund that would help defray the costs to producers of the extensive reclamation necessary to comply with the current regulations. In the meantime, US uranium tailings sites, both inactive and active, are undergoing continuing remedial action and tailings stabilization.

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AUSTRALIA

There has recently been considerable evidence that Australia's posture in the uranium industry is changing, despite what Australian spokesmen (government as well as corporate) have been prepared to admit. Although statements to the contrary were heard as recently as mid-1987, Australia and Australians now appear to be taking a more aggressive stance in the world uranium market.

It is ironic that this change in outlook is taking place under an administration that, for years as the opposition party, totally opposed all uranium development. However, practical economic and political considerations such as export earnings, taxes, employment and social programs appear to be overcoming the Australian Labor Party's historic opposition to uranium production. These factors, together with the political embarrassment associated with any policy reversal, help explain the often contradictory and uneven fashion in which this movement has proceeded, as well as the general industry sense that Australia was saying one thing and doing another. The principal changes involve the "three-mine" policy and the floor-price policy.

The "three-mine" policy refers to the Labor Party's decision to limit the number of uranium production facilities. The first two mines were the already-committed Ranger and Nabarlek projects in the Northern Territory. What Labor had originally envisioned as a "two-mine" policy was expanded to three when it became politically and economically important to support South Australia's desire to go forward with the Olympic Dam project.

A convenient justification was found in Olympic Dam's status as a "multi-mineral" project and not just another uranium mine. Now, with about 50 percent of Olympic Dam's initial uranium production under contract, there are indications that the government's attitude towards further uranium development may be softening even more. Mr. Kerin, the Minister for Primary Industries and Energy, recently noted that he was unhappy with the arbitrary nature of the three-mine policy, and would support additional uranium mining against objections that were purely ideological.

At the same time, in a paper delivered to the Uranium Institute in September 1987, CRA's Peter Bradfield appears to suggest that additional Australian uranium development could be warranted if it didn't overwhelm utility requirements. In addition, ERA's Canning Resources unit has begun an aggressive pre-marketing campaign to interest potential customers in its Kintyre deposit in Western Australia. While details on Kintyre have not yet been officially made public, it is reliably reported as being shallow, relatively high grade, and large (60 million pounds U_3O_8 proved and still open). With its politically-desirable and remote location in Western Australia and its presumed low cost of production, Kintyre must be viewed as a candidate to be the next Australian uranium project, unless delayed due to aboriginal or environmental problems in the Rudall River National Park area.

However, some observers believe that Jabiluka, Pancontinental's long-delayed Northern Territory project, will be Australia's next uranium production site. In support of Jabiluka, they note that:

1. Aboriginal, royalty and environmental problems are close to being sorted out;
2. With Nabarlek phasing down, Northern Territory authorities are very keen for a new project that can utilize and build on the existing infrastructure; and
3. The Australian penchant for fair play suggests that Pancontinental should have its turn, particularly after standing by for so long after having been denied its chance when Labor first came to power and decided against all new projects except Olympic Dam.

One possible scenario that appears to minimize potential negative political exposure involves using the existing Nabarlek mill to process high-grade ore from a new mine, and allowing Kintyre to begin a modest-sized operation in the West. Political rhetoric aside, the demise of the "three-mine" policy seems only a matter of time.

The Australian government's most visible and continuing involvement with uranium commerce has been its floor-price policy. Predictions that the government would have to agree to prices below the current floor-policy level appear either to have been realized or are close to realization. The Bradfield paper notes that:

— "the floor price should be the subject of constant review."

— "there has been a tendency for it to move lower" over the past year; and

— "the government may consider lowering the floor price even further, with the possibility of its being lifted completely within the next few years."

In view of a history of discussing the floor price in only the most guarded language, the almost casual tone of the Bradfield commentary is rather remarkable and clearly indicates that the floor price is not the inviolate barrier it

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once was. His remarks also help clarify the apparent conflict between what Australians have said (or were obliged to say) about certain recent contracts, and what the buyers have said about those same contracts.

Specific terms and conditions of contracts with Australian producers are not generally available, and much has to be inferred from the identity and known predilections of existing customers. It is clear that the Australian government, prodded by the country's current and would-be producers, is becoming more responsive to current market realities and is taking the steps necessary to prepare for industry expansion and to maintain a competitive position among world suppliers, particularly as regards Canada.

This "new" Australian outlook is coming into focus just as the US market situation is becoming more confused as a result of potential import-limiting legislation, the pending court case between the US producers and DOE, and, most recently, the announced Fair Trade Agreement between the USA and Canada. It is clear that a US-Canada trade agreement, coupled with an import embargo resulting from a victory by the US producers in their lawsuit against DOE, would be a commercial disaster for Australian marketing efforts in the USA. (It should be recalled that Judge Carrigan's original order included no grandfathering provisions with respect to existing contracts.) Other than through a program of origin swaps, it is not clear how the Australian producers could circumvent such a situation, were it to develop, and marketing in the USA would be difficult at best.

SOUTH AFRICA

Third-quarter uranium production from Chamber of Mines producers totaled 2,184,000 pounds U_3O_8, declining 14.5 percent from the second quarter of 1987 (Table 3). The largest drops in output came from Randfontein (a 50-percent drop) and Vaal Reefs (a 21-percent drop). Production from Randfontein has undergone a 58-percent drop since the fourth quarter of 1986, largely the result of strikes and labor disruptions and the mineworkers' strike in August particularly affected both Randfontein and Vaal Reefs. Only three producers increased production in the third quarter.

Table 3
REPUBLIC OF SOUTH AFRICA RECENT URANIUM PRODUCTION[1]
(Thousands of Pounds U_3O_8)

Third Quarter Operation	Fourth Quarter 1986	First Quarter 1986	Second Quarter 1987	Third Quarter 1987	Percent Change[2]
Buffelsfontein	302	271	245	240	—2.0
Driefontein Consolidated	43	41	41	42	+ 2.4
ERGO[3]	86	88	79	85	—9.0
Freegold[4]	266	275	245	223	+ 7.6
Harmony	116	102	103	97	—5.8
Hartebeestfontein	257	242	231	223	—3.5
Randfontein	356	314	297	148	—50.2
Stilfontein (Chemwes)	226	228	234	232	—0.9
Vaal Reefs	997	1,025	977	768	—21.4
Western Areas	133	127	104	124	+ 19.2
TOTAL[5]	2,782	2,714	2,555	2,184	—14.5

[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.
[2] Change in percent from the second quarter of 1987.
[3] ERGO = East Rand Gold and Uranium Company Ltd.
[4] Formerly Free State Joint Metallurgical Scheme.
[5] Columns may not add due to rounding.

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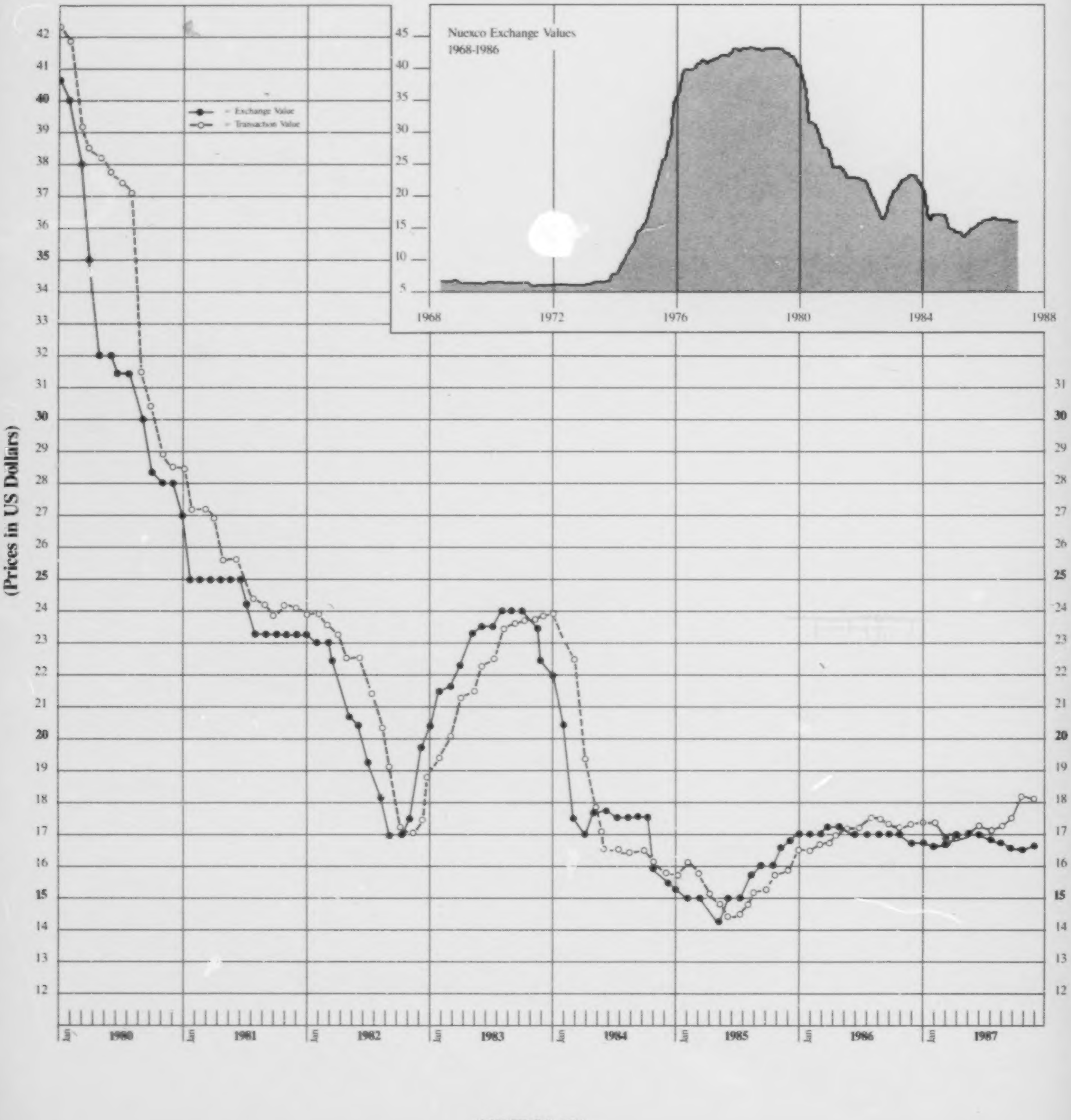
HISTORICAL MARKET DATA



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969		6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	**16.75**		

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	**18.05**		

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HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	**1.90**		

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated (US Dollars/kg. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	**47.00**		

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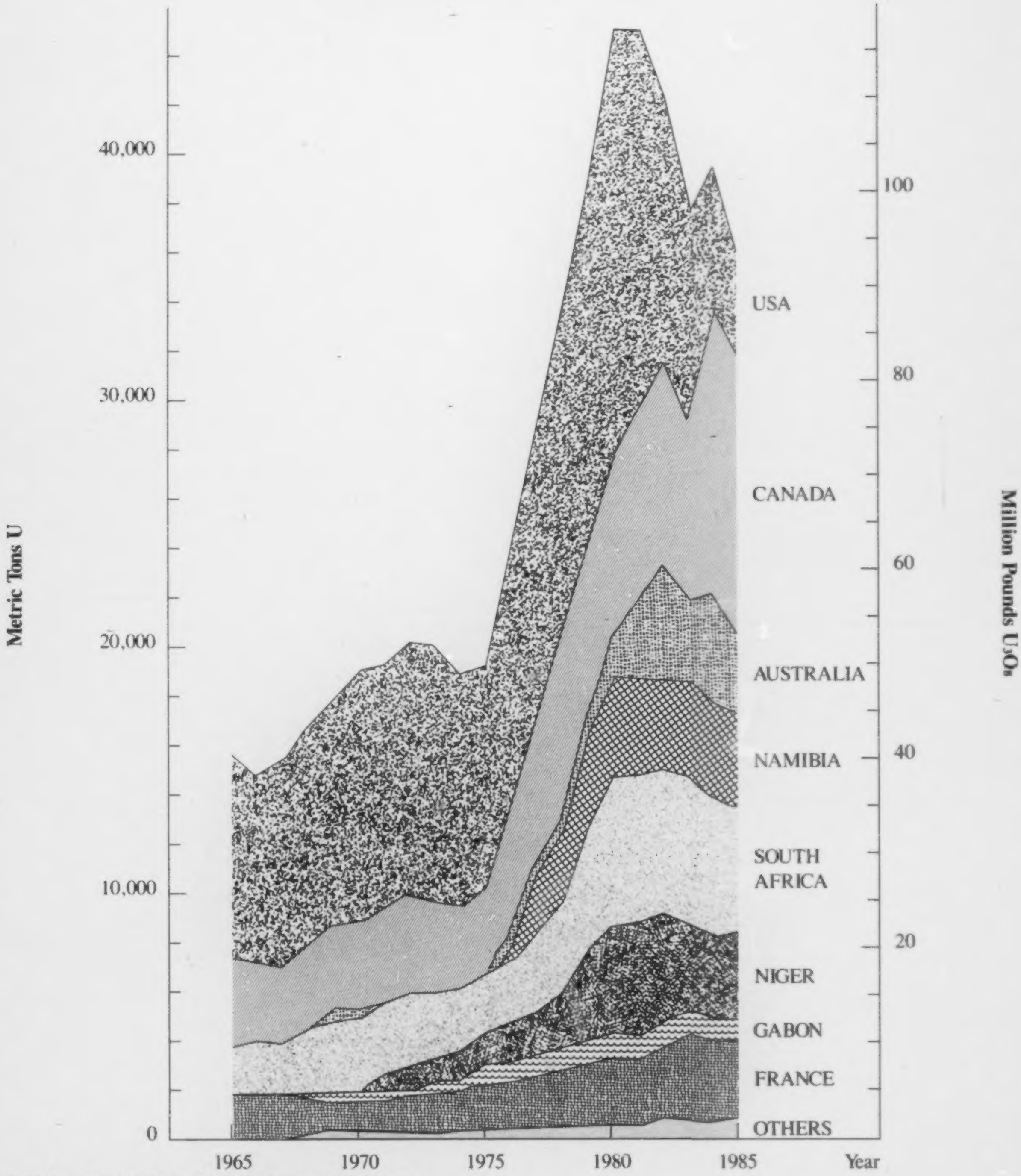
HISTORICAL MARKET DATA

HISTORICAL WOCA[1] URANIUM PRODUCTION[2]
(Compiled by OECD/IAEA Joint Report[3])



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[1] WOCA = World Outside of Centrally-planned Economic Areas.

[2] 1985 production data are preliminary.

[3] A joint report issued biennially by the OECD Nuclear Energy Agency and the International Atomic Energy Agency.

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US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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HISTORICAL MARKET DATA

VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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AUSTRALIA

		Consumer Price Index[1]	Price Index of Materials Used in Manufacturing Industry — All Groups[2]	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (1976=100)
1975	Avg.	57.9	150.4	132.6
1976	Avg.	65.7	168.4	160.9
1977	Avg.	73.8	192.0	179.0
1978	Avg.[4,5]	79.7	198.5	190.0
1979	Avg.	86.9	248.8	127.9
1980	Avg.	95.8	321.8	140.8
1981	Avg.	105.0	355.3	154.1
1982	Avg.[6]	116.7	368.6	174.9
1983	Avg.	128.5	401.6	181.9
1984	Avg.	133.6	95.3	194.4
1985	Avg.	142.6	100.0	202.7
1986	Avg.	155.5	105.0	212.9
Jan	1986	—	109.5	210.0
Feb	1986	—	108.7	210.0
Mar	1986	150.5	99.4	210.5
Apr	1986	—	94.2	210.5
May	1986	—	93.5	210.5
Jun	1986	153.0	95.6	210.5
Jul	1986	—	97.8R	215.3
Aug	1986	—	98.9R	215.3
Sep	1986	157.0	105.4R	215.3
Oct	1986	—	105.9R	215.4
Nov	1986	—	104.9R	215.6
Dec	1986	161.5	105.2R	215.6
Jan	1987	—	106.2R	215.9R
Feb	1987	—	108.9R	216.5
Mar	1987	164.7	108.4R	222.2R
Apr	1987	—	108.3R	222.0R
May	1987	—	108.1R	221.8R
June	1987	—	108.1R	221.1R
July	1987	—	—	222.3R
Aug	1987	—	—	223.1

P = Preliminary R = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: year 1980-81=100.0). Index periods are for normal calandar years; figures shown at tnd of year represent yearly average; figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. the previous index was 1969 = 100.

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Annual Averages are for financial year ending June 30.

[5] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[6] Monthly data for 1979-82 appear on page 35 of Report 184.

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GOVERNMENT STATISTICS

CANADA

			Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Industry Products Price Index: All Commodities[1] (1981 = 100)	**Uranium Mines (SIC 057)**	**Metal Mines (SIC 051-059)**	**Mines, Quarries and Oil Wells[3] (SIC 051-099)**	**Primary Non-ferrous Metal Industries[4] (SIC 296)**	**(SIC 298)**	**Chemicals and Chemical Products[5] (SIC 372-379)**
1979	Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980	Avg.	247.2	—	10.58	10.80	—	—	8.50
1981	Avg.	288.7	—	12.02	12.23	—	—	9.53
1982	Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983	Avg.	298.8	—	—	14.30	—	—	11.17
1984	Avg.	310.9	17.88	—	—	—	—	—
1985	Avg.	118.58	18.52	16.37	15.65	12.75	11.19	12.20
Jan	1986	121.0	18.15	16.22	15.86	13.11	11.48	12.52
Feb	1986	120.8	19.52	16.57	15.99	13.20	11.59	12.45
Mar	1986	120.1	19.04	16.65	15.93	13.11	11.59	12.54
Apr	1986	119.3	19.38	16.68	15.95	13.07	11.64	12.54
May	1986	118.4	19.54	16.68	15.78	13.16	11.72	12.51
Jun	1986	118.6	19.80	16.63	15.64	13.44	11.86	12.49
Jul	1986	118.8	19.51	16.34	15.48	13.28	11.73	12.52
Aug	1986	119.1	18.39	16.17	15.46	13.31	11.31	12.70
Sep	1986	119.4	19.32	16.62	15.78	13.14	11.45	12.90
Oct	1986	119.9	19.97	16.81	16.11	13.30	11.59	12.94
Nov	1986	119.9	20.11	17.01	16.24	13.42	11.66	12.93
Dec	1986	119.7	19.67	16.79	16.19	13.06	11.57	12.99
Jan	1987	120.0	19.53	16.93	16.01	13.06	12.58	12.89
Feb	1987	119.8	20.33	17.20	16.21	13.01	12.66	13.11
Mar	1986	120.4R	20.04	17.14	16.15	13.57	12.58	13.02
Apr	1987	121.2R	20.47	17.38	16.26	13.75	11.99	13.27
May	1987	122.1R	20.50	17.12	15.96	14.23	11.44	13.19
June	1987	122.5	20.23	16.94	15.70	13.65	12.77	12.88
July	1987	123.1	19.75R	16.73R	15.63R	13.90R	12.52R	12.98R
Aug	1987	123.7	20.12P	16.88P	15.80P	13.22P	12.69P	12.95P
Sep	1987	124.0	—	—	—	—	—	—

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (3Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)"Æ Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, plus a random
survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data. Wage Earner Data were further revised in January 1987 and now reflect a slightly different base than previously.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI data for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)".

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.[7]	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.88	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
1985	Avg.	68.76	151.68	192.6	181.2	726,804	396,956
Jan	1986	—	—	213.8	203.6	744,070	449,513
Feb	1986	—		215.8	206.9	754,458	438,562
Mar	1986	75.76	167.8	218.3	206.9	759,897	445,387
Apr	1986	—	—	222.2	208.9	756,388	437,563
May	1986	—	—	222.6	212.5	754,788	425,544
Jun	1986	77.65	172.0	224.4	213.3	756,637	462,365
Jul	1986	—	—	228.8	216.3	756,140	516,832
Aug	1986	—	—	232.2	220.3	760,929	502,968
Sep	1986	81.94	181.8	236.7	221.9	765,772	511,363
Oct	1986	—	—	239.3	226.8	763,953	512,897
Nov	1986	—	—	242.4	230.2	761,325	531,509
Dec	1986	85.38	189.9	244.9	232.1	752,264	536,970
Jan	1987	—	—	248.3	233.9	740,031	532,577
Feb	1987	—	—	251.0	237.0	757,872	598,986
Mar	1987	88.17	197.1	255.0	239.6	762,697	536,006
Apr	1987	—	—	258.2	242.5	761,850	533,487
May	1987	—	—	261.2	243.6	759,428R	530,981
Jun	1987	90.74	203.5	263.1	244.9	759,433	573,546
July	1987	—	—	266.2	246.8	—	—
Aug	1987	—	—	270.0	249.9	—	—
Sep	1987	—	—	273.4	—	—	—

P = Preliminary   R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria: "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

GOVERNMENT STATISTICS

UNITED STATES

		Producer Price Index[1]		Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3,4] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
		Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.[6]	274.8	268.8	246.8	85.7	10.26	10.63	8.30	6.94
1981	Avg.	304.1	293.4	272.4	94.0	11.55	11.98	9.12	7.62
1982	Avg.[7]	312.3	299.3	289.1	100.0	12.31	12.93	9.96	8.21
1983	Avg.	315.7	303.1	298.4	103.9	12.58	13.43	10.59	8.65
1984	Avg.	322.6	310.3	311.1	107.7	13.05	13.43	11.08	9.04
1985	Avg.	323.8	308.7	322.2	111.2	13.38	13.74	11.56	9.46
1986	Avg.	312.2	299.8	328.4	114.1	13.20	13.49	11.98	9.65
Jan	1986	323.8	308.9	328.4	—	13.41	13.68	11.87	9.58
Feb	1986	318.9	304.4	327.5	—	13.46	13.80	11.83	9.57
Mar	1986	314.0	300.3	326.0	112.9	13.41	13.91	11.80	9.60
Apr	1986	311.6	298.2	325.3	—	13.47	13.89	11.84	9.60
May	1986	311.6	299.2	326.3	—	13.40	13.79	11.90	9.63
Jun	1986	311.8	299.0	327.9	113.7	13.50	13.50	11.95	9.59
Jul	1986	308.5	297.4	328.0	—	13.33	13.30	12.05	9.67
Aug	1986	307.9	297.2	328.6	—	12.96	13.13		9.64
Sep	1986	308.7	297.5	330.2	114.7	13.04	13.28	12.03	9.70
Oct	1986	309.6	298.4	330.5	—	12.85	13.16	12.08	9.67
Nov	1986	309.8	298.7	330.8	—	12.75	13.14	12.17	9.73
Dec	1986	309.8	298.1	331.1	114.9	12.70	13.03	12.20	9.82
Jan	1987	313.5	300.9	333.1	—	12.94	12.98	12.18	9.84
Feb	1987	314.9	302.2	334.4	—	12.99	12.83	12.21	9.84
Mar	1987	315.7	302.7	335.9	116.1	13.04	12.79	12.24	9.84
Apr	1987	317.3	305.0	337.7	—	13.16	12.90	12.30	9.82
May	1987	318.3R	307.1R	338.7	—	12.97	12.92	12.31	9.83
Jun	1987	320.2	308.5	340.1	117.2	13.05	12.93	12.27	9.84
Jul	1987	322.6	310.2	340.8	—	13.06R	13.07R	12.37R	9.89
Aug	1987	323.8	310.5	342.7	—	13.06P	13.07P	12.32R	9.90R
Sep	1987	323.3	310.4	344.4	117.8	—	—	12.57P	9.96P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28 and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139. Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147. Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154. Monthly Data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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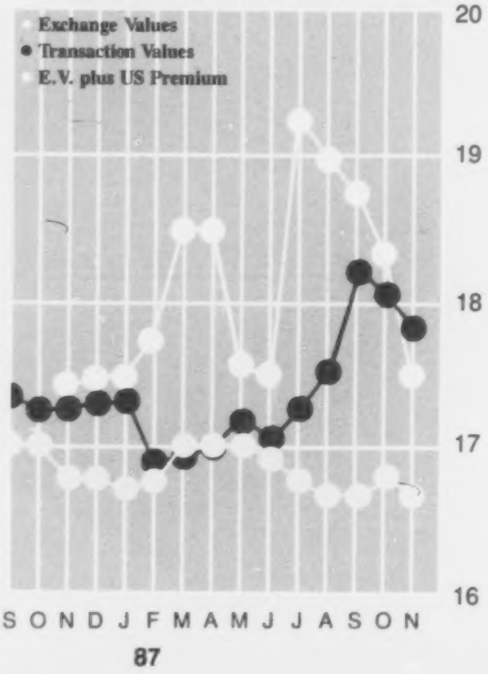

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(Canada)

George J. Stathakis
(USA)

James C.C. Stewart
(U.K.)

Hans W. Vogt
(Switzerland)

Chris I. von Christierson
(South Africa)

W. Bryan Webster
(USA)

NUEXCO

EXECUTIVE SUMMARY
REPORT 232
(All data as of November 30, 1987)

Exchange Value
$16.65, down $0.10

The **Exchange Value** is **$16.65** per pound U_3O_8, down $0.10 since last month. The US Premium (relative to the Exchange Value) is $0.85, down $0.80 since last month.

UF_6 Value
$47.00, unchanged

The **UF_6 Value** is **$47.00** per kilogram U as UF_6, unchanged since last month. The US Premium (relative to the UF_6 Value) is $2.25, down $0.85 since last month.

Transactions

Eight recent natural uranium sales are reported, involving **1.8 million** pounds equivalent U_3O_8. Seven of the sales involved spot or near-term delivery, and five met the conditions for inclusion in the Transaction Value. In addition, one sale of low-enriched uranium is reported. Active spot and near-term **uranium supply** amounts to **6.8 million** pounds U_3O_8 equivalent, up 1.1 million pounds since last month. Active spot and near-term **uranium demand** totals **1.3 million** pounds, down 790 thousand pounds from last month. The spot and near-term **supply-demand ratio** increased to **5.4 to 1**.

Transaction Value
$17.80, down $0.25

The **Transaction Value** is **$17.80** per pound U_3O_8, **down $0.25** since last month. The calculation includes transactions involving a total of 3.3 million pounds U_3O_8 and equivalent UF_6, of which 1.8 million pounds are US-origin, and covers a period of 3 months.

Loan Rate
3.5%, down 0.5%

The **Loan Rate** is **3.5 percent** per annum, down 0.5%. No loan transactions are reported.

Conversion Value
$1.90, unchanged

The **Conversion Value** is **$1.90** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 550 thousand pounds U as UF_6. Active demand totals 220 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: $73,
up $4.00

The **SWU Value** at .3% tails assay and for delivery within one year is **$73** per SWU, up $4.00 since last month. Four secondary market SWU transactions are reported.

* * *

China

The People's Republic of China has an active, growing nuclear industry, with three reactors currently under construction and several more in the planning stage. China has established nuclear cooperation agreements with many countries, and its trade in nuclear-related goods and services is growing. This article examines China's historical nuclear planning, links with other countries, and its reactor construction program.

FASB

The Financial Accounting Standards Board (FASB) has recently issued several "Statements of Financial Accounting Standards" that further define and clarify how utility accounting procedures should deal with plant disallowances, abandonments and phase-in plans.

Italy

In a referendum held November 8, 1987, Italian voters have overturned three current laws that deal with government authority to override local opposition to power plant siting, financial incentives that may be offered to localities willing to host a power plant, and the participation of Italy's state utility ENEL in international nuclear projects, such as the Superphenix fast breeder reactor in France.

Raw Materials

Radiometric sorting of uranium ores offers certain production cost advantages to those producers able to use this technology. This article discusses how this technique may be applied and outlines radiometric sorting equipment in use at several sites around the world.

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NUEXCO REPORT 232 FIGURES OF THE MONTH (November 30, 1987)	This Month (Report 232)	Last Month (Report 231)	12 Months Ago (Report 220)
Exchange Value ($US per pound U_3O_8)	16.65	16.75	16.75
US Premium for the Exchange Value ($US per pound U_3O_8)	0.85	1.65	0.65
UF_6 Value ($US per kilogram U as UF_6)	47.00	47.00	48.00
US Premium for the UF_6 Value ($US per kgU as UF_6)	2.25	3.10	2.50
Transaction Value ($US per pound U_3O_8 equivalent)	17.80	18.05	17.30
Loan Rate (Per Annum)	3.5%	4%	4%
Conversion Value ($US per pound U as UF_6)	1.90	1.90	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	6.8	5.7	4.5
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	1.3	2.0	0.8
Near-Term Supply-Demand Ratio	5.4	2.9	5.9
Recent Uranium Sales:[3]			
Number of Transactions	9	13	6
Quantity of Material (Millions of pounds U_3O_8 equivalent)	1.8	9.4	0.8
Nuexco SWU Value: ($US per SWU) :			
at 0.3 tails assay	73	69	80
US DOE SWU Prices: ($US per SWU)			
USEC	117.00[4]	119.00[5]	119.00[6]
AFC	153.00	153.00[7]	153.00[7]
Requirements	157.00	157.00[7]	157.00[7]
Incentive Price	90.00[8]	90.00[8]	90.00[8]
Market Value of Enriched UF_6[8]: ($US per kgU as UF_6)			
2.5 w/o U_{235}	441	432	459
3.0 w/o U_{235}	563	551	588
3.5 w/o U_{235}	688	673	719
4.0 w/o U_{235}	814	796	852

---

[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/85.

[7] Effective since 10/1/84.

[8] Effective since 10/1/86, for up to 30% of annual requirements.

[9] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

December 1987 No. 232

R. GENE CLARK, *EDITOR* CHARLES B. LEWIS, *ASSISTANT EDITOR*

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November 30, 1987	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$16.65**/lb. U_3O_8	6,845	1,275
US Premium	**$0.85**		
UF$_6$ VALUE	**$47.00**/kgU		
US Premium	**$2.25**		
CONVERSION VALUE	**$1.90**/lb. U as UF$_6$	550	220
SWU VALUE 0.3 tails assay:	**$73**/SWU	500	25
LOAN RATE	3.5%/annum	5,100	0

TRANSACTION VALUE

$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
17.80	3.3	18	3

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF$_6$ Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. **The US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF$_6$ Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed awillingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materialss delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of November 30, 1987)

The **Exchange Value** is **$16.65** per pound U_3O_8, down $0.10 since last month. US-origin uranium is commanding a **premium** (relative to the Exchange Value) of **$0.85** per pound U_3O_8 (down $0.80) in the form of concentrates, and $2.25 per kilogram U (down $0.85) in the form of UF_6. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **6,845,000** pounds U_3O_8 equivalent, up 1.1 million pounds since last month. The corresponding figure for **active demand** is **1,275,000** pounds, down 790,000 pounds. The spot and near-term supply-demand ratio increased to 5.4 to 1.

The *Current Market Data* section of this Report lists six U_3O_8 sales, totaling 1.1 million pounds U_3O_8 equivalent.

The **Transaction Value** is **$17.80** per pound U_3O_8, down $0.25 since last month. The calculation extends over a 3-month period and includes 18 transactions involving 3.3 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$47.00** per kilogram U in UF_6, unchanged since last month. Three transactions involving UF_6 are reported, totaling approximately 700,000 pounds equivalent U_3O_8.

The **Conversion Value** is **$1.90** per pound U as UF_6, unchanged since last month. Active supply of secondary market conversion services totals 550 thousand pounds U as UF_6. Active demand totals 220 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is **3.5 percent** per annum, down 0.5 percent since last month. No loan transactions are reported.

* * *

The Exchange Value declined $0.10 to $16.65 per pound U_3O_8 this month, as the supply of material available on the market increased substantially and demand for concentrates declined. Sellers of non-US-origin uranium have been offering their material at prices around the Exchange Value level for the few available market opportunities. Overall, there has been little activity in the market for non-US-origin U_3O_8, and only one transaction is reported.

The Premium (relative to the Exchange Value) for US-origin U_3O_8 declined $0.80, to $0.85 per pound. Because of the uncertainties presented by the US Producers vs. DOE lawsuit and the proposed US-Canada Free Trade Agreement (FTA), a number of potential US buyers have decided, at least for the present, to await further developments before committing to procurement decisions. Demand for US-origin uranium remains at relatively low levels, and many buyers are currently unwilling to pay any premium for US-origin material. On the other hand, supply of US-origin U_3O_8 is plentiful and suppliers are competing aggressively for available US-origin opportunities.

This competition can be partly attributed to US producers' year-end cash flow requirements. Some US producers also feel that, because of the FTA, the prospects for a higher US premium and/or a restricted market in the USA are poor, prompting increased aggressiveness to move material at lower price levels.

As of the end of the month, two buyers reportedly were close to concluding transactions for US-origin material. One other US buyer is in the spot market for a significant quantity of US-origin material. Although one non-US utility is seeking a large quantity of US-origin material for extended delivery, that buyer's demand is discretionary with regard to both quantity and timing.

The *Current Market Data* Section of the Report shows five spot or near-term U_3O_8 transactions, involving approximately one million pounds. In addition, one long-term transaction is listed, between a US producer and a US utility, involving slightly less than one million pounds of US-origin U_3O_8. Five of the six U_3O_8 transactions reported this month invoived US-origin material.

The UF_6 Value remained unchanged at $47.00 per kgU as UF_6. Overall, the market for UF_6 has changed little since last month, showing weak demand for UF_6 of any origin. The Premium (relative to the UF_6 Value) for US-origin UF_6 declined $0.85 to $2.25. This decline was relatively less than that of U_3O_8 due to the smaller available supply of US-origin UF_6, compared to US-origin U_3O_8, and to the generally less active market. Three UF_6 transactions are reported this month, all of non-US origin, involving approximately 650,000 pounds U_3O_8 equivalent, including one sale of low-enriched uranium.

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The Loan Rate declined slightly, to 3.5 percent per annum, reflecting a sharp increase in the supply of material available for loan. Although there appears to be little or no active demand for loans, there are indications that large quantities of material, of almost any origin desired, could be made available for loans, provided that lenders' requirements for security can be met. The supply of material available for loan has increased significantly, as has the aggressiveness of potential lenders. No loan transactions are reported this month.

* * *

The Conversion Value remained unchanged this month at \$1.90 per pound U as UF_6. The secondary market for conversion services remains largely inactive, with little or no available supply of bargain-priced conversion. Demand for conversion remains weak. No conversion transactions are reported.

ENRICHED URANIUM AND SWU

The SWU Value is \$73 per SWU, up \$4.00 since last month. The secondary SWU market is relatively quiet, with little active demand and a wide range of SWU prices based on origin, location and various risk factors to buyers. The increase in SWU Value represents the lessening in importance of highly discounted non-western SWU in the US market, since almost no buyers presently in the market are willing to take such SWU. (One of last month's potential buyers of non-western SWU concluded a transaction for DOE-origin enrichment at near the SWU Value, instead of taking the non-western enrichment that was offered.) Four SWU transactions are reported, totaling approximately 100,000 SWU. Two of these transactions involved the purchase of enriched uranium product.

THE US-CANADA FREE TRADE AGREEMENT

Negotiations over the FTA's final language are reported to be close to completion. However, there remain many unanswered questions and criticisms regarding the Agreement, and its passage in either the US Congress or the Canadian Parliament is far from certain.

In November 1987, House Energy and Commerce Committee Chairman John Dingell (D-Michigan) sent a letter to the Reagan Administration that included more than 40 detailed questions about the FTA. This letter noted that several Congressional Committees could want to amend the FTA in ways that would satisfy the objections of some affected industries, including oil, pharmaceuticals, uranium, automobiles, and others.

According to an internal memorandum from the US Trade Representative's office, the fast-track procedure for Congressional approval and implementation of the FTA may, in fact, be rather easily changed by Congress. Such a change would be necessary if Congress insists on amending the FTA as it currently exists.

> "At any time the House Rules Committee could recommend and report a change in the rules to the House floor. Adoption of such a resolution requires only a majority vote ... Likewise in the Senate, normally the Senate Rules Committee would review and report a resolution to change the rules. Adoption of such a rule change normally requires a majority vote. The Rules Committee may be bypassed entirely and a rule change adopted on the Senate floor if unanimous consent were obtained (but even a single objection would block unanimous consent)."

The memo also notes that:

> "January 2, 1988 is the only day the President can enter into the Agreement. If he signed any earlier, he would not be in compliance with the 90-day notice requirements of section 102(e)(1) of the Trade Act of 1974, as amended. If he signed any later, the authority under section 102 for such agreements would have expired (unless extended in the interim by legislation)."
>
> "As a matter of law, we believe that there is no deadline for submission by the President to

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the House and Senate of the Agreement, implementing legislation and required statements.

"As a *political* rather than legal matter, Bob Dove of Senator Dole's office (and the former Senate parliamentarian) believes that many Members believe that eligibility for fast track consideration requires submission of the implementing legislation on January 2, 1988. The only possible legal basis for this view is Section 151(c)(1), which refers to the "day on which a trade agreement is submitted (to the Congress) . . . *under section 102*" (emphasis added), authority under which expires at midnight on January 2, 1988. However, the prevailing legal view is that trade agreements entered into under section 102 prior to its expiration are eligible for Congressional fast track review any time thereafter."

— Correction —

On Page 25 of last month's Report, we erroneously reported Mr. Peter Bradfield as representing CRA. In fact, Mr. Bradfield represents Energy Resources of Australia (ERA). We regret the error and any inconvenience it may have caused.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Nov 30, 1987)**	**Last Month (Oct 31, 1987)**	**12 Months Ago (Nov 30, 1986)**	**This Month (Nov 30, 1987)**	**Last Month (Oct 31, 1987)**	**12 Months Ago (Nov 30, 1986)**
Australia (dollar)	24.02	24.98	25.85	62.43	64.95	67.20
Belgium (comm. franc)	580.34	608.43	694.16	1,509	1,582	1,805
Canada (dollar)	21.80	22.07	23.22	56.69	57.39	60.36
EEC (ecu)	13.47	14.04	16.16	35.02	36.50	42.02
Finland (markka)	68.01	71.34	82.31	176.82	185.46	213.99
France (franc)	94.33	98.01	108.98	245.25	254.81	283.32
FRG (mark)	27.82	29.03	33.27	72.34	75.47	86.50
Italy (lira)	20,462	21,006	23,116	53,197	54,610	60,097
Japan (yen)	2,245	2,318	2,715	5,837	6,027	7,059
Netherlands (guilder)	31.30	32.69	37.86	81.38	84.98	98.43
South Africa (rand)	32.84	33.53	37.64	85.38	87.18	97.86
Spain (peseta)	1,866	1,952	2,254	4,852	5,075	5,859
Sweden (krona)	100.30	103.97	115.68	260.76	270.31	300.73
Switzerland (franc)	22.84	24.04	27.69	59.39	62.50	71.98
UK (pound)	9.28	9.76	11.75	24.13	25.37	30.55
US (dollar)	16.65	16.75	16.75	43.29	43.55	43.55

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Nov 30, 1987)**	**Last Month (Oct 31, 1987)**	**12 Months Ago (Nov 30, 1986)**	**This Month (Nov 30, 1987)**	**Last Month (Oct 31, 1987)**	**12 Months Ago (Nov 30, 1986)**
Australia (dollar)	25.62	26.92	26.70	66.75	69.99	69.41
Belgium (comm. franc)	620.43	655.65	706.95	1,613	1,705	1,864
Canada (dollar)	23.31	23.79	23.98	60.60	61.84	62.34
EEC (ecu)	14.40	15.13	16.69	37.44	39.33	43.40
Finland (markka)	72.71	76.87	85.01	189.04	199.85	221.01
France (franc)	100.85	405.62	112.56	262.19	274.58	292.62
FRG (mark)	29.75	31.28	34.37	77.33	81.33	89.34
Italy (lira)	21,875	22,636	23,875	56,871	58,849	62,070
Japan (yen)	2,400	2,498	2,804	6,240	6,495	7,291
Netherlands (guilder)	33.46	35.23	39.10	87.00	91.58	101.66
South Africa (rand)	35.11	36.14	38.88	91.27	93.95	101.07
Spain (peseta)	1,995	2,104	2,328	5,187	5,469	6,052
Sweden (krona)	107.23	112.04	119.48	278.77	291.28	310.61
Switzerland (franc)	24.42	25.91	28.60	63.49	67.35	74.34
UK (pound)	9.92	10.52	12.14	25.80	27.34	31.55
US (dollar)	17.80	18.05	17.30	46.28	46.93	44.98

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on November 27, 1987.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF₆ This Month (Nov 30, 1987)	Last Month (Oct 31, 1987)	12 Months Ago (Nov 30, 1986)	per kg. U as UF₆ This Month (Nov 30, 1987)	Last Month (Oct 31, 1987)	12 Months Ago (Nov 30, 1986)
Australia (dollar)	2.74	2.83	2.78	6.04	6.25	6.12
Belgium (comm. franc)	66.23	69.02	74.60	146.00	152.15	164.46
Canada (dollar)	2.49	2.50	2.49	5.49	5.52	5.50
EEC (ecu)	1.54	1.59	1.74	3.39	3.51	3.83
Finland (markka)	7.76	8.09	8.85	17.11	8.75	19.50
France (franc)	10.76	11.12	11.71	23.73	12.40	25.82
FRG (mark)	3.18	3.29	3.58	7.00	7.26	7.89
Italy (lira)	2,335	2,383	2,484	5,148	5,253	5,477
Japan (yen)	256.20	262.98	291.78	564.83	579.76	643.27
Netherlands (guilder)	3.57	3.71	4.07	7.88	8.17	8.97
South Africa (rand)	3.75	3.80	4.04	8.26	8.39	8.92
Spain (peseta)	212.98	221.45	242.20	469.54	488.20	533.95
Sweden (krona)	11.45	11.79	12.43	25.23	26.00	27.41
Switzerland (franc)	2.61	2.73	2.98	5.75	6.01	6.56
UK (pound)	1.06	1.11	1.26	2.34	2.44	2.78
US (dollar)	1.90	1.90	1.80	4.19	4.19	3.97

SWU VALUE AND UF₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value at 0.30% tails assay (Nov 30, 1987)	UF₆ Value per kg.U in UF₆ This Month (Nov 30, 1987)	UF₆ Value per kg.U in UF₆ Last Month (Oct 31, 1987)
Australia (dollar)	105.29	67.79	70.09
Belgium (comm. franc)	2,544	1,638	1,707
Canada (dollar)	95.60	61.55	61.93
EEC (ecu)	59.06	38.02	39.39
Finland (markka)	298.20	191.99	200.17
France (franc)	413.60	266.28	275.01
FRG (mark)	121.99	78.54	81.45
Italy (lira)	89,714	57,761	58,942
Japan (yen)	9,844	6,338	6,505
Netherlands (guilder)	137.24	88.36	91.72
South Africa (rand)	143.98	92.70	94.09
Spain (peseta)	8,183	5,268	5,478
Sweden (krona)	439.76	283.13	291.74
Switzerland (franc)	100.15	64.48	67.46
UK (pound)	40.70	26.20	27.38
US (dollar)	73.00	47.00	47.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on November 27, 1987.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4193	1989-1992	601-1,000	R[3]	Producer	Utility	US-Origin
4196	1988	301-600	108-112	Producer	Intermediary	UF_6
4198	1988	50-100	103-107	Producer	Utility	US-Origin
4199	1988	50-100	103-107	Producer	Utility	US-Origin
4210	1988	less than 50	98-102	Producer	Intermediary	US-origin
4211	1988	50-100	98-102	Intermediary	Utility	US-Origin
4212	1988	101-300	108-112	Producer	Intermediary	UF_6
4213	1988	50-100	98-102	Producer	Intermediary	
4214A	1988	50-100	98-102	Intermediary	Utility	Contained in low-enriched uranium

Enrichment Services Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4203	1988	50-100	98-102	R[3]	Utility		
4207	1988	less than 50	R[3]	Intermediary	Fabricator		Contained in high-enriched uranium
4214B	1988	less than 50	98-102	Intermediary	Utility		Contained in low-enriched uranium
4215	1988	less than 50	98-102	Utility	Utility	DOE	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

URANIUM SUPPLY
(November 30, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1002	270	—	
87-1023*	750	500 per year	1987-90
87-1053	100	400 per year	1989 on
87-1055	200	300 per year	1988-93
87-1061*	200	200 per year	UF_6, 1988 on
87-1091	1,000	1,000 per year	UF_6
87-1120	1,000	—	
87-1123	400	—	
87-1124*	1,000	500 per year	1988 on
87-1130	750	—	
87-1142	150	—	
87-1152*	200	—	
87-1156*	825	—	
87-1001	—	400 per year	1989 on
87-1005	—	400 per year	1988-95
TOTAL:	6,845		
INACTIVE			
87-1017	1,000	—	
87-1059	120	—	UF_6
87-1130	850	—	UF_6
87-1135	500	—	
87-1019	—	600 per year	1988-91
TOTAL:	2,470		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1014A, 1022, 1025, 1097, 1109.

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CURRENT MARKET DATA

URANIUM DEMAND
(November 30, 1987)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near -term[2]**	**Intermediate or Long-term**	**Remarks**
Inquiries to Purchase: ACTIVE			
87-1030	175	—	
87-1121	650	650 per year	1988-96
87-1124*	75	—	UF_6
87-1138	175	—	UF_6
87-1140	200	—	
87-1013	—	1,200 per year	1990-95
87-1021	—	200 per year	1992 on
87-1107*	—	1,225	1990-92
87-1108	—	200 per year	1991-2000
87-1134	—	260	1989
87-1150*	—	1,000 per year	1989-92
TOTAL:	1,275		
INACTIVE			
87-1040	300	300	1989
87-1049	—	700 per year	1989-96
87-1114	525	—	
87-1125	390	—	
87-1146*	25	—	
TOTAL:	1,240		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1007,1047, 1048, 1073.

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LOAN SUPPLY AND DEMAND
(November 30, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1064	600	—	
87-1119	500	—	
87-1157*	4,000	—	
TOTAL:	5,100		
INACTIVE			
87-1012	2,000	—	
87-1031	1,000	—	
87-1033	1,000	—	
87-1071	1,000	—	UF_6
TOTAL:	5,000		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

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CONVERSION SUPPLY AND DEMAND
(November 30, 1987)

	Delivery Period[1] (Thousands of Pounds U as UF_6)		
Nuexco Project Number	**Within 3 Years**	**Beyond 3 Years**	**Remarks**
Available for Sale: ACTIVE			
87-1155*	550	—	
TOTAL:	550		
INACTIVE			
87-1008	750	750	
87-1122	330	—	
TOTAL:	1,080		
Inquiries to Purchase: ACTIVE			
87-1132	220	—	
TOTAL:	220		
INACTIVE			
87-1009	220	—	
87-1072*	440	—	
TOTAL:	660		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

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SWU SUPPLY AND DEMAND
November 30, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1058*	100	—	1987
87-1068	100	—	1988
87-1096	300	—	1988
TOTAL:	500		
INACTIVE			
87-1004	55	—	1987
87-1059	25	—	1987
87-1128	300	—	1987
87-1130	150	—	1989
TOTAL:	530		
Inquiries to Purchase:			
ACTIVE			
87-1154*	25	—	1988
TOTAL:	25		
INACTIVE			
87-1065	150	—	1988
87-1116*	100	—	1989
TOTAL:	250		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 1100.

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CHINA'S NUCLEAR POWER PROGRAM

Introduction

The People's Republic of China has, since the 1950s, built a fairly extensive nuclear industry, incorporating a military reactor program, a number of research reactors and fuel-cycle facilities, and development of domestic uranium resources. The Institute of Atomic Energy in Beijing operates a 10-MWth research reactor, a 3.5 MWe pool-type reactor and a 12-MWe heavy water reactor, upgraded from its original 7 MWe. Shanghai's Atomic Energy Research Institute, which conducts research into reactor design, in 1984 commissioned a 27-MWe PWR. Currently, a 5-MWth water-heating reactor is being built by the Institute of Nuclear Technology at Qinghua University, combining technologies from the FRG and the USSR. In 1980, the Southwest Institute of Reactor Design Engineering at Jiajiang, in Sichuan province, commissioned China's largest research reactor, a 125-MWe high-flux unit. Shortly after this unit began operating, Premier Li Peng noted that it was the tenth indigenous research reactor to be commissioned in China.

China currently has three commercial PWRs under construction — a twin-unit (2 x 960-MWe) station at Daya Bay near Hong Kong and Guangzhou, and a single 300-MWe unit at Qinshan, near Shanghai. The Daya Bay station is being built by a consortium headed by Framatome and Electricite de France (EdF) and is based on current French PWR technology. The plant at Qinshan is a domestic design, built mainly with Chinese-manufactured equipment.

China's International Nuclear Agreements

In nuclear technology and trade, China's relationships with other countries gradually have extended to the point where relatively normal commerce is able to take place. China has entered into bilateral nuclear cooperation agreements with many countries, including Argentina, Belgium, Brazil, the Federal Republic of Germany, Finland, France, Italy, Japan, Pakistan, Switzerland, the United Kingdom and the USA.

China's bilateral cooperation agreements with other countries provide a vital link for contacts between Chinese personnel from any of several organizations, and persons from the other country, who might work for the government, or for research organizations, trade entities, or private companies. Exchanges of technical information and personnel, as well as equipment sales, often are organized through channels opened by these cooperation agreements.

On January 1, 1984, China joined the International Atomic Energy Agency (IAEA) and stated that it would voluntarily adhere to IAEA safeguards conventions. However, as is the case with France, the PRC remains outside the Non-Proliferation Treaty (NPT) structure. After lengthy discussions with the IAEA, China offered to let that organization conduct inspections of certain civilian nuclear facilities, in much the same way as do the other "nuclear weapons states."

Argentina — In 1985, Chinese Vice Minister Lin Zhongtang visited Argentina, touring several engineering and supplier companies. Later, the two countries signed a cooperation agreement covering research, design, construction and operation of turbine generators, uranium mining, conversion, and fuel fabrication. Argentina's development of heavy water production facilities, enrichment and reprocessing reportedly also were topics of discussion. Two shipments of heavy water have been bought by Argentina from China, but to date, no contracts between Chinese and Argentine equipment suppliers are known to have been finalized.

Brazil — A cooperative agreement was signed in 1985 between China and Brazil. Brazil's nuclear industry, which offers a number of services and products, hoped that the cooperation agreement would lead to increased trade, but no activity has been reported between China and Brazilian nuclear-industry companies.

Canada — In 1984, representatives of the Chinese Nuclear Society signed a technical exchange agreement with the Canadian Nuclear Society, as well as touring a number of Canadian facilities. For some time, China has imported most of its gamma-ray (Cobalt-60) radiation sources for medical and industrial uses from Canada.

Finland — In July 1987, the governments of China and Finland signed a nuclear cooperation agreement that would promote closer ties between the two countries. The agreement came in conjunction with a long-term uranium sale by China to TVO (Teollisuuden Voima Oy), a Finnish utility, to supply 600 MT of uranium between 1988 and 1995, about 30 percent of TVO's requirements in that period.

France — Chinese-French nuclear cooperation began with the signing of an agreement in 1975, and France's

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involvement in China's nuclear industry is perhaps the most extensive of any foreign country. The twin reactor complex at Daya Bay, near Guangzhou, is being supplied largely by French manufacturers, chiefly Framatome. China also has sold uranium to the French utility Electricite de France (EdF).

Federal Republic of Germany — Companies from the Federal Republic of Germany (FRG) also have a long-standing relationship with China's nuclear industry, and have been involved in nuclear-related business ventures or proposals in several areas, including supplying reactors, aiding in uranium exploration, and buying Chinese uranium. For some time, many observers believed that Kraftwerk Union (KWU) would get the order to supply twin 900-MWe reactors for the proposed Sunan site, near Shanghai. A number of German companies had interests in this venture, which included various countertrade possibilities designed to offset much of the hard currency required to build the plants as a turnkey project. The negotiations also included the possibility of China's disposing of or storing some German spent reactor fuel at a site to be chosen in the Gobi desert. However, when the Chinese leadership decided in favor of greater domestic development of nuclear technologies, the Sunan project was "indefinitely postponed," at least as a turnkey job.

KWU continues to maintain a presence in China, however, and is actively participating in a feasibility study to determine what type and size, if any, may be appropriate for additional units to be added to the Qinshan site. In August 1987, Chancellor Helmut Kohl visited China, and while no formal agreement was signed, the visit prompted the Chinese government to state officially its intention to continue the two countries' ongoing bilateral cooperation. This cooperation has largely been carried out under the auspices of Kraftwerk Union.

Japan - China's first preliminary understanding on nuclear cooperation with Japan was reached in March 1984, and was the precursor to a formal commercial relationship in nuclear trade between the two countries. In May 1986, Japan's Diet finally approved the official nuclear cooperation agreement with China that had been signed in mid-1985 by representatives of the two countries. The agreement calls for cooperation in reactor design and construction, nuclear waste disposal technology, and research and information exchanges. As early as 1982, Japan's Power Reactor and Nuclear Fuel Development Company (PNC) began buying small amounts of uranium from China, delivered in several shipments through 1985. These purchases represented China's earliest commercial sales of uranium abroad, and demonstrated that the Chinese could supply U_3O_8 of acceptable purity, and on a timely schedule. Japanese organizations also are involved in joint uranium exploration or production feasibility studies in China, and are supplying various types of equipment and services to the Qinshan and Daya Bay projects.

Switzerland - In November 1986, the government of Switzerland signed a bilateral nuclear cooperation agreement, followed in May 1987 by the Swiss Federal Executive Council's recommendation that Parliament ratify the agreement. Under the proposed pact, Swiss utilities will be able to buy uranium directly from China, and Swiss industry can more easily supply services, equipment, and technology to China. The accord also lets Switzerland pursue the possibility of sending spent fuel and vitrified high-level waste to China for storage, reprocessing or permanent disposal.

USA — An agreement was first signed in July 1985 between the USA and the PRC, and on December 31, 1985, a 30-year US-China nuclear cooperation agreement took effect, after an exchange of notes by US and Chinese government officials in Beijing. Under the agreement, the State Department gave the NRC authorization to proceed with issuance of all pending licenses for transfer of nuclear-related technology to China.

Following the signing of the initial agreement, but before its approval by Congress, a number of export licenses had been authorized. Several pending applications, however, had been held back, such as one allowing Mitsubishi Heavy Industries Ltd. to ship the completed reactor pressure vessel, which it built under license from Westinghouse, to the Qinshan project. Since the signing of the agreement, American companies and their non-US licensees have been much more free to pursue sales of equipment or licensing arrangements with the Chinese. The signing of the agreement took place just before China's decision to cut back on purchasing of foreign materials and on foreign involvement, generally, in China's nuclear power development program.

The full text of the arrangements finally was negotiated in June 1987, and has since been undergoing interagency review. Finalization requires that President Reagan certify to Congress that the arrangements of the cooperation agreement will ensure that exports of US equipment are used for peaceful purposes. Before any exports can be licensed, the certification must be before Congress for 30 days of continuous session.

United Kingdom — China also has a long-standing

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relationship with the UK in nuclear commerce, and the UK's General Electric Company (GEC) is one of the suppliers for the Daya Bay project. Much of the early negotiation over the Daya Bay project concerned the participation in the venture of the Hong Kong Utility, China Light and Power, and the involvement of the British government in securing a portion of the Daya Bay business for companies in the UK. Financing for the project was partially handled by a consortium of ten British banks, led by the Midlands Bank. In addition, the Chinese and British governments have had considerable interaction over the status of the UK's relinquishing of Hong Kong to the Chinese in 1997.

China's Nuclear Planning

During the past five years, China's commercial nuclear development plans have undergone considerable change. Originally, these plans called for installation of 10,000 MWe of nuclear generating capacity by the year 2000, and international reactor manufacturers had high hopes of a large export market to China.

By 1985, ongoing negotiations with foreign suppliers for twin-unit nuclear projects at Daya Bay, near Hong Kong, and at Sunan, north of Shanghai, pointed to a near-term construction program of nearly 4,000 MWe that was open to bids from foreign suppliers. Other sites also were being investigated in Liaoning Province and at Jinshanwei, also near Shanghai. Completing the 10,000-MWe nuclear capacity called for in the plan would have meant building at least six other large reactors in addition to those planned for Daya Bay and Sunan.

The French companies Framatome and Electricite de France (EdF), in conjunction with the UK's GEC, took an early lead in the bidding for Daya Bay. In December 1985, the Chinese and the French and British companies involved in Daya Bay signed a memorandum of understanding, agreeing in principle to sign contracts for the Daya Bay project. Having such a memorandum indicated that most of the fine points of the negotiations had been settled, and cleared the way for a formal letter of intent to purchase. On March 12, 1986, letters of intent were signed with the principal suppliers for Daya Bay.

KWU, on the other hand, appeared to be in the best position to win the contract for the Sunan project; its interest was closely tied to countertrade possibilities that included accepting Chinese nonferrous metals and other materials as part payment, buying Chinese uranium, and possibly storing or disposing of some spent fuel from Germany in China. However, on March 3, 1986, within three months of the Daya Bay memorandum of understanding, Chinese officials announced that negotiations over the Sunan project were being indefinitely postponed, due to lack of available funds.

Then, in April 1986, after a visit with Premier Zhao Ziyang to the Qinshan reactor site, Deputy Prime Minister Li Peng surprised western suppliers by announcing that China's nuclear construction program would henceforth rely as greatly as possible on indigenous technology. Under the new policy, major foreign involvement would be limited to the Daya Bay project, at least as far as primary design and construction were concerned. Zhao stated that nuclear plants built in the near future would likely be based on technology similar to that used in the 300-MWe Qinshan design, uprated to the 600 or 900-MWe range. The nuclear energy plan was downgraded to 6,000 MWe nuclear capacity by 2000, from 10,000 MWe. Li reiterated the same sentiment in mid-1987, stating that nuclear power was not considered as a primary electric power source, but rather would be used only in certain places, and only as China could afford. The emphasis on hydropower and coal would continue unchanged.

One of the main reasons behind this shift in policy was concern over the economics of the Daya Bay project. From the beginning, financing the Daya Bay venture depended heavily on the financial participation of China Light & Power, thereby limiting the investment required of China. The Guangdong Nuclear Power Joint Venture Company (GNPJVC), which is the project owner, is a joint venture between Guangdong Nuclear Investment Company (75-percent) and China Light and Power (25-percent).

Even though much of the investment would be paid through electricity sales to Kowloon and the New Territories (Hong Kong Island is served by Hong Kong Electric, not a partner in the joint venture), Hong Kong's electricity consumption growth rate has been declining, especially in manufacturing-related demand. At the same time, joint-venture partner China Light & Power also shifted its position, saying that it intended to use its portion of Daya Bay's output for peak rather than base loads, and therefore could not guarantee to take as much of the plant's power as originally hoped.

The Daya Bay station's planned drain on hard currency reserves considerably influenced how scarce foreign exchange would be distributed throughout the rest of the

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nuclear program. There was no room in the budget for two foreign-supplied twin-unit power stations, and plans for Sunan were put aside.

Another problem for China's nuclear planners concerned the availability of materials. In order to assure that materials would be available to build these prospective nuclear plants, a high degree of priority would have to be given to their construction. Shortages of materials often have threatened China's large construction projects with delays, and have caused much competition among various bureaucracies attempting to ensure scheduling of their projects. The high government priority assigned to Qinshan, for example, has enabled that project's civil and mechanical construction to continue approximately on schedule, but has evoked heated criticism for its diversion of resources from other projects. Timely construction of a whole program of nuclear plants would require a masssive shift in construction priorities to the nuclear program. There is little assurance of a large nuclear program getting such attention.

There was a solid rationale for concentrating more resources on domestic production. Capital costs and loan costs of foreign-sourced nuclear plant construction are much higher than for those built in China. Even though building nuclear plants using domestic designs and fabrication as much as possible would limit technology transfer from the West and Japan, China has long felt the need to assert its independence in this area of high technology. One drawback at present is the limited capacity of existing electrical grids and limited regional interconnection. Of the more than 20 power grids in China, only four exceed 8,500 MWe in installed generating capacity, and most would be unable to accommodate nuclear plants of more than 200 MWe unless interconnected.

In July 1987, China and the FRG officially decided to continue with bilateral nuclear cooperation, during a visit to China by Chancellor Helmut Kohl. The decision had been helped by KWU's participation, even after the Chinese decision to pursue an indigenous-only program, in a joint feasibility study with China's Ministry of Nuclear Industry to explore ways to develop a 600-MWe reactor loosely based on the Qinshan design. The study showed that KWU's help in building a 600-MWe reactor could include an acceptable balance between Chinese and foreign involvement, while providing considerable technical assistance.

Accordingly, since Kohl's visit there have been some indications that the indigenous-only policy could be modified to once-again include foreign assistance for additional reactors at the Qinshan site. Although China has not actually committed itself, the key to the plan's success probably lies in the type of arrangements that can be made to pay for the foreign participation in the plants.

Negotiations, evidently carried out over a lengthy period of time and at a high political level between the Chinese and West German governments as well as representatives of KWU and several German utilities, have once again centered around a multi-faceted countertrade arrangement involving reactor design and equipment supply, purchases of Chinese uranium by German utilities, and possible storage or reprocessing in China of German utilities' spent fuel. This would likely include a high degree of Chinese manufacturing involvement in any reactor construction, considerable technology transfer to China, as well as competitive pricing of Chinese uranium.

Thus, although the role of KWU and the FRG in China's nuclear planning appears to be unofficial as yet, the current nuclear development plan, based on domestically-built reactors, appears to again be changing. The plan now aims to develop a domestic manufacturing base for the 300-MWe PWR design such as is found at Qinshan, with some outside design and manufacturing assistance in upgrading to 600-MWe. China clearly intends to eventually produce indigenously the types of equipment that currently are being imported for Qinshan, as soon as domestic facilities can attain the technical levels required; technology licensing will be preferred over out-of-country manufacture.

At present, Chinese energy plans appear to accept in principle the construction of up to four additional 600-MWe PWR units at the Qinshan site. The 300-MWe reactor under construction is now officially scheduled for trial operation in 1990, and probably will not start commercial operation before the early 1990s. The site will then be open for additional construction. However, it seems perhaps too ambitious for four more units to be completed at that site by 2000, and under the most optimistic scenario, China would not have more than 4,500 MWe of nuclear capacity, including Daya Bay, by the year 2000.

The current planning is generally consistent with China's industrial development philosophy as it has been implemented over the last thirty years. China has managed to avoid the large foreign debts that plague most less developed nations, and to the maximum degree possible has avoided turnkey development projects. This does not mean

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that foreign companies should abandon hope of participation in China's nuclear program. Components will continue to be imported as needed, and licensing arrangements as well as design services will be selectively sought.

Other Planning and Research

Although they are not likely to receive nuclear plants in the near future, at least two other sites also have undergone preliminary investigation — the Sunan site earlier planned for a turnkey reactor project that was canceled, and a site in Liaoning Province that has been mentioned but not as extensively investigated. A reactor complex at Sunan would serve the densely populated and highly industrialized Yangtze River delta region near Shanghai, Hangzhou, Souzhou, and other cities. Building on this site might have the added advantages of fairly rapidly increasing power capacity to the delta, while avoiding a bottleneck if more than one reactor at a time were underway at Qinshan.

It is possible that China will proceed with plans to build at least one, and possibly two medium-sized reactors for district heating. Two northern cities, Harbin and Shenyang, have included proposals for such reactors in their development plans. Qinghua University in Beijing has for some time been actively developing a 5-MWth prototype heating reactor, and reportedly is set to install such a unit 60 km northwest of Beijing, providing heating for 70,000 m^2 of building area. This reactor is a modified BWR, using 3-percent enriched uranium fuel, designed for a high degree of inherent safety. Cooling is by natural circulation, with three circuits. The middle, or secondary circuit carries higher pressure than either the primary or tertiary circuit (the one carrying heated water away from the plant), preventing leakage into the secondary circuit from either side.

Active research and planning is underway at Harbin, under the direction of the State Scientific and Technology Commission, to determine the requirements for building a 450-MWth, low-temperature district heating reactor. Such a unit would supply heat to a ten million m^2 building complex, saving 600,000 tons of coal per year, and also could possibly operate in conjunction with the Yilin coal gasification project at Harbin.

Chinese nuclear planners also have investigated the possibilities of using nuclear plants for co-generation, producing both electricity and process heat or steam for large industrial complexes. One of the sites mentioned in 1984 and 1985 was Jinshanwei, south of Shanghai near the Qinshan project. The government investigated the possibility of building twin 450-MWt reactors to supply power and steam to the Shanghai General Petrochemical Plant, which now burns oil to generate the 500 tons of steam needed per hour. Such a reactor plan would free some oil resources for local power generation, but would not contribute directly to the electricity grids. The petrochemical complex sits on very soft ground, and the Southwest Reactor Engineering Research and Design Institute in Sichuan has conducted detailed site planning and technical studies into design of the nuclear island.

Current Nuclear Projects

Qinshan — Plant 728, otherwise known as Qinshan, located 92 km from Hangzhou and 126 km southwest of Shanghai (Figure 1), had its start in 1972, when Premier Zhou Enlai first approved funds for its development. From the start, Qinshan has been a flagship project intended to demonstrate China's self-reliance in nuclear engineering. The original PWR design was based on experience gained in China's nuclear submarine program. At 300 MWe, the plant is the smallest of any current or planned commercial units and its size has left it vulnerable to criticism concerning cost-effectiveness, compared to coal-fired power plants. It remains a high-priority item under the current five-year plan, however, and has considerable visibility as a symbol of Chinese progress and self-reliance in high technology.

Civil construction began in March 1984, requiring removal of over one million cubic meters of rock and soil in order to begin construction of the main buildings. The civil engineering and construction is being carried out by the Nuclear Engineering Company, under the direction of the Ministry of Nuclear Industry. Construction of the main reactor buildings started in January 1985, and the 7.5 m-thick concrete foundation mat was completed by June. The civil works were basically completed by mid-1987.

Participation by foreign firms in the Qinshan project is expected to total from 20 to 30 percent of the $300-400 million total project cost. The reactor pressure vessel has been built by Mitsubishi Heavy Industries (Japan), KSB (FRG) is supplying the main coolant pumps, Sandvik (Sweden) is providing the steam generator tubing, Sulzer (Switzerland) will supply the steam isolation and turbine bypass valves, and Pirelli (Italy) will provide cables. In-core instrumentation is to be provided by Framatome, at a cost of about $1 to 1.5 million.

The project's 300-MWe turbine generator and moisture separator reheaters are being supplied by Shanghai Turbine

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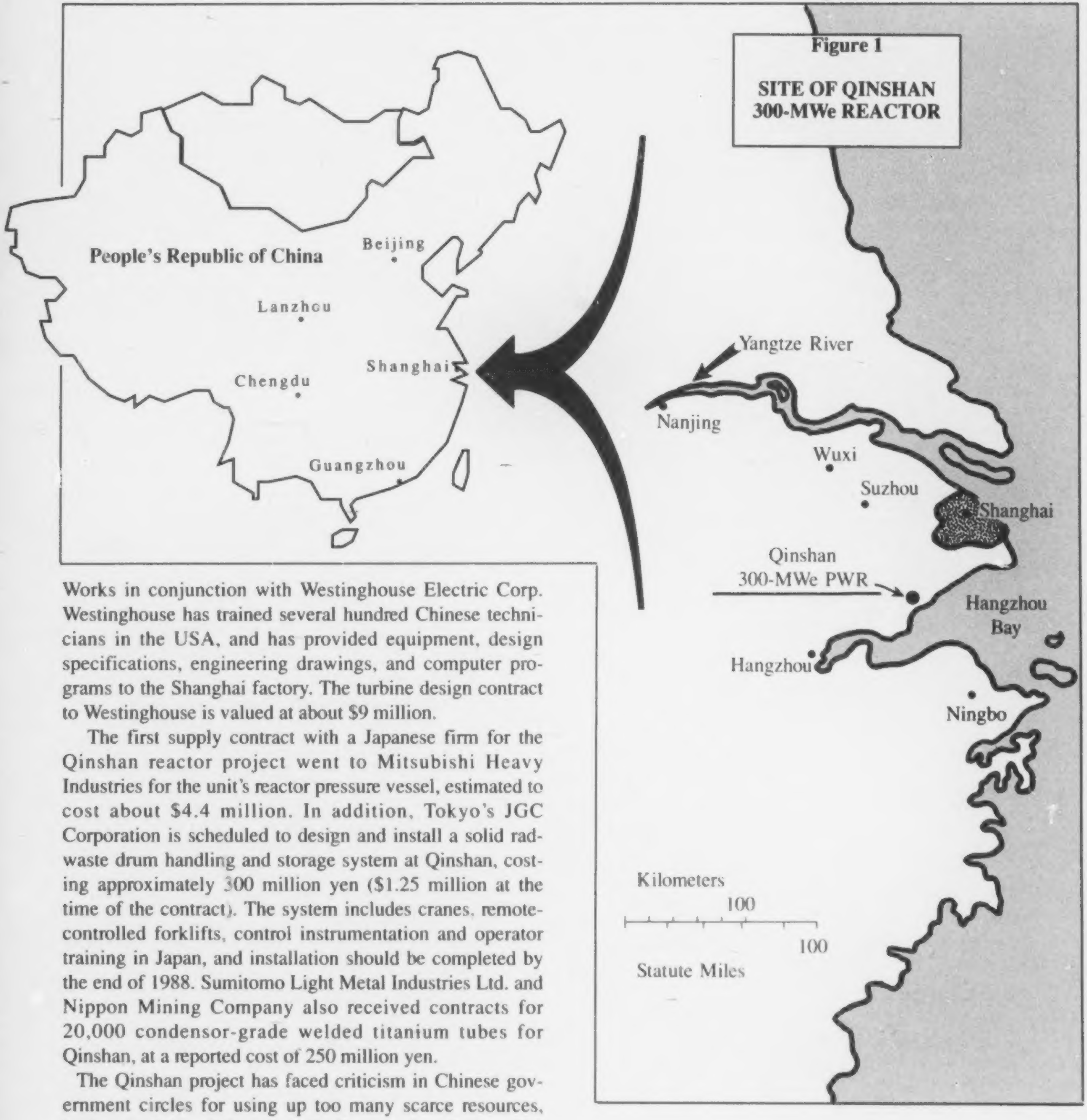
People's Republic of China
Beijing
Lanzhou
Shanghai
Chengdu
Guangzhou
Yangtze River
Nanjing
Wuxi
Suzhou
Shanghai
Qinshan
300-MWe PWR
Hangzhou Bay
Hangzhou
Ningbo
Kilometers
100
100
Statute Miles

Figure 1

SITE OF QINSHAN 300-MWe REACTOR

Works in conjunction with Westinghouse Electric Corp. Westinghouse has trained several hundred Chinese technicians in the USA, and has provided equipment, design specifications, engineering drawings, and computer programs to the Shanghai factory. The turbine design contract to Westinghouse is valued at about $9 million.

The first supply contract with a Japanese firm for the Qinshan reactor project went to Mitsubishi Heavy Industries for the unit's reactor pressure vessel, estimated to cost about $4.4 million. In addition, Tokyo's JGC Corporation is scheduled to design and install a solid radwaste drum handling and storage system at Qinshan, costing approximately 300 million yen ($1.25 million at the time of the contract). The system includes cranes, remote-controlled forklifts, control instrumentation and operator training in Japan, and installation should be completed by the end of 1988. Sumitomo Light Metal Industries Ltd. and Nippon Mining Company also received contracts for 20,000 condensor-grade welded titanium tubes for Qinshan, at a reported cost of 250 million yen.

The Qinshan project has faced criticism in Chinese government circles for using up too many scarce resources, both material and financial. Scaling up the plant to 300 MWe from the original naval reactor design meant

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acknowledging that the Chinese nuclear industry was not yet able to produce some major components needed for large-scale commercial power reactors. Buying these components abroad required increasing the allocation of hard currency reserves for the project, and domestic costs also have approximately doubled from the original estimate. Justification for buying foreign-made parts has been made easier now that Qinshan officially is the prototype for a proposed indigenously-based nuclear construction program.

By mid-1987, over 70 percent of the internal reactor parts, and over 50 percent of all major components have reportedly been completed; the entire Qinshan project is said to be approximately two-thirds finished. Although the original official schedule called for completion by 1989, the schedule has now been extended to 1990. Western observers say that even that date may have to be pushed back, to perhaps 1991.

Daya Bay — For international reactor suppliers, one of the most desirable major nuclear plant orders of the 1980s involved the 2-unit PWR project at Daya Bay, near Guangzhou (Canton) and Hong Kong (Figure 2). Negotiations for the project started in 1979, and for a time, Daya Bay appeared to be the forerunner of a significant nuclear power program in China, in which foreign suppliers could have a major presence. Although those plans have been scaled back, the Daya Bay plants still were one of the few new nuclear plant construction projects available to international nuclear industry suppliers in the early and mid-1980s.

The owner of the twin-unit, 960-MWe PWR plant is Guangdong Nuclear Power Joint Venture Company (GNPJVC), which is a joint venture of China Light & Power Company of Hong Kong (25-percent) and Guangdong Nuclear Power Company (75-percent). Under the venture's agreement, the Hong Kong partner will have the option to take up to 70 percent of the units' electricity when the plants go into operation in the early to mid-1990s.

The first phase of site preparation began in April 1984, and was completed by July 1986. Primary civil construction started shortly after. The site requires construction of a nuclear island, ship docking facilities, an underground waterproof wall over one kilometer long, a reservoir, and a highway connecting the island to the city of Shenzhen, about 50 km away.

The protracted negotiations were formalized on September 23, 1986, when Framatome, Electricite de France and General Electric Company of the UK signed final contracts for the supply of engineering and equipment. Framatome's fixed-price contract covers construction management of the nuclear islands, supplying of the nuclear steam supply systems plus auxiliary systems and equipment, and the first two reactor cores for each unit. The contract is valued at approximately 6 billion French francs (about $980 million at current exchange rates). EdF is to act as architect-engineer and will also provide consulting services, in a contract valued at slightly over 1 billion francs. GEC Turbines Limited, a subsidiary of GEC, will supply two 900-MWe turbine generators valued at more than $350 million. The Daya Bay plants are based on the three-loop technology found in 34 French PWR plants, and EdF's Gravelines Units 5 and 6 are considered the reference units for the Chinese project.

EdF's contribution includes acting as consultant to the owner, GNPJVC, in various levels of project management. EdF is participating in negotiations concerning the civil contracting, as well as contracts for various equipment items that are not covered under the contracts to the main suppliers, Framatome and GEC. EdF's responsibilities also include overall engineering for the project, engineering studies for much of the station buildings, excluding the turbine building, and advising on operating procedures. The project management team, consisting of EdF and GNPJVC personnel, will be working both in Shenzhen and in France, and will oversee quality control on equipment manufactured inside and outside China.

Chinese personnel also will be trained in operating procedures both in China and in France. Operating personnel will train on simulators first, then will be assigned to a French PWR plant of a similar design for hands-on training. The Chinese State Nuclear Safety Administration reportedly has bought a second-hand three-loop Westinghouse PWR simulator from the USA, to be part of Qinghua University's Institute of Nuclear Energy Technology. The simulator will be installed in the Institute's new nuclear plant training center near Beijing. Chinese personnel are working to adapt the unit to simulate the new plant's operations.

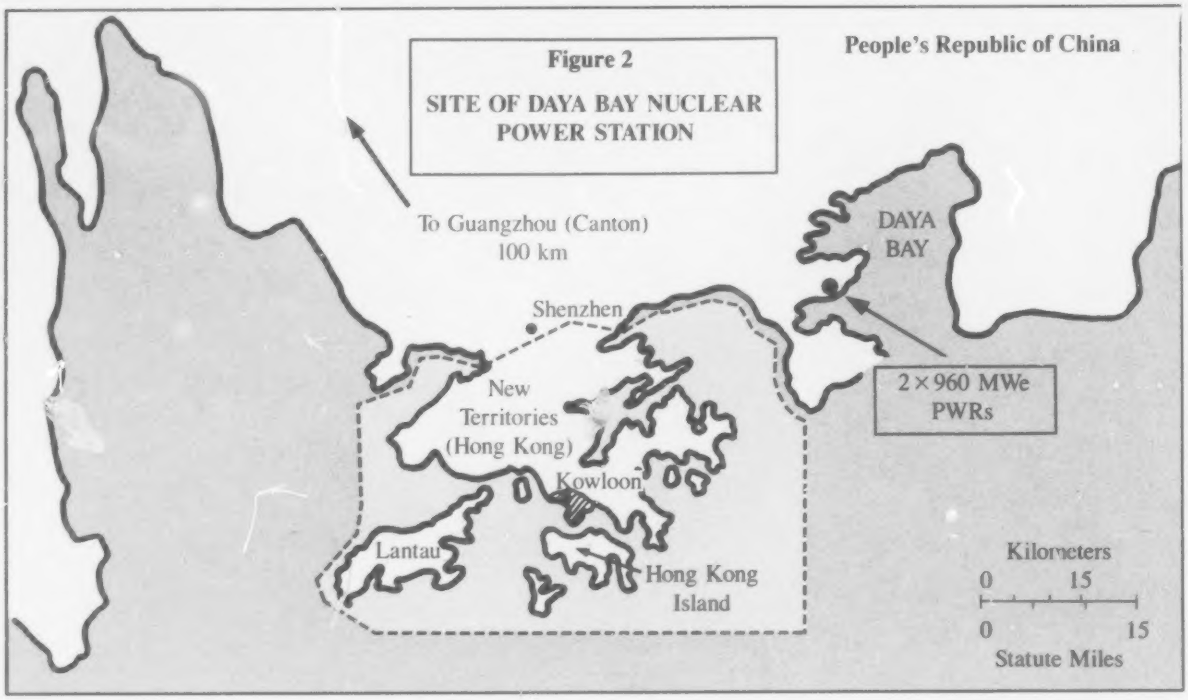

Figure 2

SITE OF DAYA BAY NUCLEAR POWER STATION

The primary civil construction is being performed by a joint-venture of several organizations. China's Huaxing Nuclear Industry Construction Company and the Second Bureau of China State Construction Engineering Company have been awarded contracts for 50 percent and 5 percent of the civil work, respectively. France's Campenon Bernard and Japan's Maeda Construction Company have 35 percent and 10 percent interests, respectively. Campenon Bernard is the technical leader for the nuclear island construction, while Maeda is technical leader for balance-of-plant construction. The civil engineering portion of the project is valued at about $224 million, and will include the reactor and fuel storage buildings, as well as other facilities at Daya Bay.

In other contracts with non-Chinese suppliers, 120 km of nuclear power transmission lines will be built by a Japanese-British consortium consisting of Sumitomo Electric Industries and Balfour Beatty Power Construction Ltd. of London. The 400 and 500-kv lines will provide power for Kowloon and the New Territories, and are expected to be completed by 1992. The contract is with China Light and Power and is reported to be worth 12 billion yen (US$ 83 million).

Bechtel North American Power Corp., with Bechtel China Inc., also has signed a contract to provide quality assurance consulting for the Daya Bay project. Bechtel will monitor quality assurance, both on-site in Guangdong, and at sites in Europe and China where various components are being built, as well as providing training for Chinese personnel.

The total cost of the Daya Bay project is estimated to be about $4.1 billion, of which the French share is about $1.3 billion, and the British share is about $350 million.

Conclusion

China's experience with nuclear power is substantial, but primarily involves plutonium production and research-type reactors. Overall, China has established an extensive network of bilateral cooperation agreements with many countries, including nearly all countries with significant nuclear industries. These agreements have increasingly brought China into the mainstream of international nuclear power developments, and nuclear-related trade with many countries has increased steadily over the past several years.

At present, two nuclear power stations are under construction -- a 300-MWe indigenously-designed PWR at Qinshan and the twin 960-MWe PWRs at Daya Bay, near

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Hong Kong. Prospects for foreign participation in China's nuclear program have changed considerably with policy swings involving debates on the most desirable mix of electric generating technologies, and with changing levels of China's foreign currency reserves.

It now appears that China will allow a limited amount of foreign assistance in its nuclear program, perhaps involving KWU's help with additional reactors for the Qinshan site in the mid-to-late 1990s, but that China intends to build a domestic nuclear industry to the maximum extent possible. Future sales to China by foreign firms may be closely tied to a considerable degree of technology transfer, as well as possibly including countertrade-type financial arrangements that would spare China the need to use its hard currency reserves for payment.

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ITALY

In a referendum held on November 8, 1987, Italian voters voted to overturn three laws, concerning nuclear plant siting, financial incentives to localities, and Italy's participation in international energy projects. The turnout for the referendum was lower than expected, only 62.5 percent of registered voters compared to 77.9 percent at a referendum two years ago, a figure that has been used by nuclear advocates to downplay the apparent further anti-nuclear shift in public opinion.

1. The existing law on power plant siting (not just nuclear plants) was overturned by a majority of 80.6 percent of the voters. This means that the central government will no longer be able to override local opposition to power plant sites.

2. The law appropriating funds to cities or towns that agree to accept plant sites was defeated by a 79.7-percent vote. Local authorities will no longer be offered financial incentives to accept plant sites in their areas.

3. A 71.9-percent majority overturned ENEL's (Ente Nazionale per l'Energia Elettrica — the Italian state utility organization and owner of Italy's commercial nuclear plants) right to participate in international nuclear projects, such as the Superphenix fast breeder reactor.

The referendum mandates that legislation be introduced within 120 days to repeal the three laws. However, the process of abrogating the laws and replacing them with new ones could take a considerable length of time to complete, during which ENEL may continue to operate on a business-as-usual basis.

The repeal of the three existing laws places severe constraints on any further nuclear development in Italy, and is likely to further curtail existing nuclear construction and development. Although at present, nuclear generated electricity only amounts to about 5-6 percent of generating capacity, additional nuclear development will be very difficult to achieve if needed. Since no alternatives were offered in the referendums, there is likely to be a period of considerable uncertainty, particularly with respect to how new power plant sites are to be chosen, and to the financial inducements, if any, that can be offered for new plant development.

The ruling Christian Democrat (CD) Party, at one time a strong supporter of nuclear power, recently has been embroiled in political problems unrelated to nuclear development, and so has been increasingly unwilling to challenge the anti-nuclear Green Party and the Socialists over nuclear-related issues. In fact, the CD Party recently announced that it would not advocate supporting nuclear energy in the upcoming referendum. In light of this policy reversal, the results of the referendum became nearly a foregone conclusion.

While the attitude of the public to future nuclear construction appears to have been demonstrated, the effect on existing plants is not so clear. Italy's three operating commercial reactors have been shut down since October 1986, at first for periodic refuelling and inspection and maintenance, and then because nuclear authorities have withheld approval to restart the units until the results of the referendum had clarified the plants' operating status.

For the near term, the Caorso (862-MWe BWR) and Trino-1 (270-MWe PWR) plants will likely go back into operation, but the Latina unit, a 210-MWe Magnox that entered service in 1963, probably will be closed and decommissioned. Two twin-unit nuclear stations are under construction in Italy — the Montalto di Castro station (2 x 1,000-MWe BWRs, scheduled for completion in about 1990) and the second station at Trino Vercellese (2 x 1,000-MWe PWRs in the early stages of construction). Their completion will depend on gaining approval from the Italian Parliament, an outcome that is far from certain. One plausible scenario could be completion of the Montalto di Castro units, but indefinite deferral or cancellation of the second station at Trino.

The referendum also has limited ENEL's authority to engage financially in international nuclear projects. However, one legal interpretation of the referendum is that it will be applicable only to future projects, and should not adversely affect projects already underway. At present, ENEL is a 33-percent shareholder in NERSA, the consortium owner of the 1,240-MWe Superphenix fast breeder reactor at Creys-Malville in France. Now that the Superphenix unit is operational, albeit with certain problems that have required the reactor to be shut down temporarily, ENEL's need to support the project financially is largely finished, and the utility can now reap some of its 400-MWe share of the plant's generating capacity. Since Italy must now import electricity from France anyway, withdrawing from NERSA would not help ENEL's cost outlook and could even hurt it. ENEL also is a 33-percent shareholder in ESK, a parallel consortium formed at the same time as NERSA to build a second large fast breeder plant in the FRG. As this project has not been started, it could be argued that the referendum's prohibition would be applicable to that project. In such a case, and since ENEL has not invested significant funds in ESK, it could presumably withdraw its commitment without great financial loss.

RECENT CHANGES IN UTILITY ACCOUNTING PROCEDURES — DISALLOWANCES, ABANDONMENTS AND PHASE-IN PLANS

Introduction

The Financial Accounting Standards Board (FASB), the private-sector panel that establishes policies for financial reporting, recently has issued revised standards for certain types of accounting procedures common to utilities that operate or are constructing nuclear units. These new standards will affect the manner in which utilities and public utility commissions view various events surrounding power plant construction, operation, rate-making, and capital recovery. The seven-member FASB panel consists of senior accountants appointed by trustees of the Financial Accounting Foundation. The panel issues "Statements of Financial Accounting Standards" which are accepted as authoritative accounting policy.

The events covered in two recent FASB statements, while relevant to all US utilities, are of particular interest to those utilities with nuclear programs. This is due to the inordinately large capital costs involved in building nuclear plants, as well as the increased scrutiny of public utility commissions in rate-making decisions for such utilities. In December 1986, FASB approved the issuance of a Statement that prescribes the proper accounting treatment for cost disallowances for recently completed plants and abandoned (canceled) plants. A Statement specifying the accounting treatment for cost "phase-in" plans for new units was released in August 1987. Both Statements were amendments of FASB Statement No. 71, entitled "Accounting for the Effects of Certain Types of Regulation", which was issued in 1982 and dealt with accounting treatment of various concepts for regulated utilities. Issues that had increased in importance in recent years warranted new analysis by the FASB, resulting in the amended rulings. Taken together, the new Statements will have important implications for those utilities involved in costly nuclear construction programs, as well as those experiencing cost disallowances in the course of PUC hearings.

Disallowances and Abandonment — Statement 90

FASB Statement 71, issued in December 1982, addressed various accounting treatments by utilities for their assets, plant construction, and rate-making, among other things. During and after the ruling, many utilities experienced cost disallowances and plant cancellations, most of which were nuclear plants. Shortly thereafter, the Board realized that these major events affecting the utility industry were not sufficiently discussed in Statement 71, and the Board decided to amend it to provide more specific guidance for the treatment of those events. In essence, the aim of the amendment was to clarify the accounting practices for those events so that a utility's financial reports most fairly represented its financial condition. Thus, Statement 90 was created to amend Statement 71 on the issues of plant abandonments, disallowances, and capitalization of allowance for funds used during construction (AFUDC). Statement 90 essentially requires that utilities write off the costs of canceled units and disallowed construction costs much faster than has been the practice.

When it becomes probable that an operating asset or an asset under construction will be abandoned, the cost of that asset shall be removed from construction work-in-process or plant-in-service. Any disallowance of all or part of the cost of the abandoned plant that is both probable and reasonably estimable shall be recognized as a loss. The present value of the future revenues expected to be provided to recover the allowable cost of that abandoned plant and return on investment, if any, shall be recorded as a separate new asset. Any excess of the remainder of the cost of the abandoned plant over that present value also shall be recognized as a loss.

Thus, utilities will be required to write off disallowed costs as a one-time charge against income, rather than as a decrease in income over the life of the plant, which has been the current practice. In this manner, any costs disallowed for recovery by the regulatory agency having jurisdiction would be recognized as an immediate loss on the utility's financial statements. The amount of the loss or write-off would equal the amount disallowed.

For abandoned plants, a similar treatment will be encouraged under the new standard. If a plant under construction is canceled, the utility will be required to report, on a present value basis, the probable future revenue that is expected to result if the cost of the plant is allowed in the ratemaking. A loss would be reported for the excess of the carrying value of the abandoned plant and the present value of the expected revenues from the plant. It is important to note that such revenues must be reported on a present-value basis to reflect the time value of money.

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Under the above scenario, a utility could list future revenues from an abandoned plant as an asset under two conditions:

1. The costs of the canceled plant were determined to be prudent and were allowed to be recovered in rates; and

2. The carrying costs of the canceled plant did not exceed the present value of such revenues.

However, this is not likely to be the case for most nuclear utilities. The extremely large capital costs of nuclear units, combined with the long construction times and regulatory delays, usually dictate that carrying costs of the canceled plant will exceed the present value of allowable costs. In those cases, reporting an immediate loss, or write-off, will be required.

In all of these cases, the reporting of the loss or present-value future revenue must be made as soon as the cancellation of the plant is probable, as defined in another FASB Statement. This has caused some controversy in the utility industry, in that utilities forced to report immediate write-offs for disallowances and canceled plants will be in effect reducing the company's assets. Any reduction of assets or value in the company, in the case of utilities, will lead to a reduction in book value and possibly the lowering of bond ratings and other financial indicators. Indirectly, write-offs can negatively affect a utility's ability to borrow funds or issue dividends on company stock.

Finally, Statement 90 specifies that allowances for funds used during construction (AFUDC) are to be capitalized (reported as an asset) only if it is probable that regulators will allow those costs to be recovered from ratepayers. Previously, Statement 71 required the capitalization of AFUDC in certain circumstances; the new Statement elaborates by stipulating that there be some certainty that the regulatory agency will find those AFUDC costs to be allowable.

On October 26, 1987, the FASB released for public comment a proposed Technical Bulletin intended to clarify an example in FASB Statement 90 entitled "Regulated Enterprises — Accounting for Abandonments and Disallowances in Plant Costs," relating to the computation of a loss on an abandonment. FASB Project Manager Paul R. LePage notes that "the proposed Bulletin states that the example in question does not accurately reflect the intent of Statement 90 and proposes a new example that would reflect that intent." The FASB is expected to issue a final Technical Bulletin before the end of the year that gives examples for computation of a loss on an abandonment.

Phase-In Plans — Statement 92

When a utility completes the construction of a new power plant, conventional rate-making methods establish rates to recover the allowable costs of the plant. These allowable costs include current operating costs, depreciation, interest on borrowed funds invested in the plant, and an allowance for the utility based on a reasonable profit margin. The latter is intended to represent a "fair rate of return" on shareholders' investment in the plant. Because of the vastly increased costs in building power plants in recent years, particularly nuclear plants, the initial inclusion of construction costs into the rate base when the plant begins service can result in "rate shock", or sharp increases in rates because of the sudden inclusion of the costs of a new plant. Phase-in plans have been formulated as perhaps the best way to mitigate the effects of rate shock. Under such plans, part of the current operating costs related to a new plant that normally would be recovered through current rates are instead deferred for recovery in future years, so that the recovery is made over a given period of time in the interests of maintaining customers' rates at a reasonable level.

On August 13, 1987, the FASB issued the second amendment to Statement 71, through its Statement 92. Statement 92 specified the manner in which utilities should account for costs deferred by regulators under phase-in plans. The Statement applies to utilities that have either completed or performed "substantial physical construction" of plants by January 1, 1988. Furthermore, the new standard specifies four criteria that must be met in order for the capitalization of the costs to be acceptable.

1. The formal plan must be agreed to by the regulator;

2. The plan must specify when the complete recovery will occur;

3. All allowable costs deferred under the plan must be scheduled for recovery within 10 years of the date when deferrals begin; and

4. The percentage increase in rates in a given year must not be greater than the percentage increase in the previous year. This requirement prevents "backloading", or scheduling a small portion of the costs in the first few years while deferring the bulk of the costs to the later years of the plan, effectively postponing rate shock instead of avoiding it.

If any of the above criteria are not met, allowable costs deferred under the plan could not be capitalized, or listed as an asset for financial reporting purposes. Thus, it is in the interest of the utility to establish a phase-in plan that meets all of the necessary criteria.

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Industry Reactions

The FASB allowed public comment on the preliminary standards by releasing an "Exposure Draft" in December 1985 and holding a public hearing in June 1986 (see Report 214, June 1986, page 16). The Exposure Draft covered all of the issues that eventually comprised both Statements. At the time of the hearing, there was a great deal of controversy over the drafts, as a record number of participants commented on the proposed revisions. However, for the most part, the final Statements differed little from the original draft; the issue of phase-in plans was removed and handled in a separate manner, resulting in the issuance of two Statements. Both Statement 90 and Statement 92 become effective for fiscal years beginning after December 15, 1987.

There still exist a variety of opinions regarding the new standards. Some industry participants are disenchanted by the fact that Statement 92 requires either all or none of the allowable costs to be capitalized, depending upon whether the specific criteria are met. While some observers viewed the ten-year phase-in requirement as arbitrary and unrealistic, others felt it would help restore credibility to utility financial reporting. The latter argued that the concept of utility bankruptcy is a possibility in some situations, and many believe that financial risk associated with new nuclear plants should be accurately represented on a utility's balance sheet.

Reactions to Statement 90 generally have been more vocal because of the immediate and direct influence it will have on earnings and shareholders' investment. Moreover, the sometimes arbitrary nature of PUC disallowances has placed some utilities in the position of defending purchases or construction costs that may have been standard at the time they were incurred, but are not prudent in today's context. Utilities are therefore concerned that unfavorable PUC decisions made in hindsight will be magnified by the new FASB standards and will adversely affect bond and credit ratings, investment potential, and common stock value.

It is likely that the risks of subjecting earnings and shareholder rewards to decisions from PUCs, implemented through the new standards, will continue to discourage utilities from constructing new nuclear units. The lack of orders for new units in the USA is at least partially due to the likelihood that some portion of construction costs will be retroactively found to be imprudent, for reasons such as high construction costs or existing excess capacity. The fact that the new FASB standard requires such liabilities to be recognized all at once rather than over time is likely to be a further indication to utilities that nuclear construction is a high-risk venture.

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RADIOMETRIC ORE SORTING

Introduction

Since the late 1950s, uranium ore has been sorted using radiation monitoring equipment to distinguish between ore grades. Sorting may be applied to individual pieces of ore or to bulk units such as truck loads. While this article focuses on the sorting of individual pieces, most uranium mines, surface and underground, use some type of radiation scanning equipment to classify bulk units into two or more categories. Doing this helps identify waste and minimizes mill head grade fluctuations by blending stockpiled material to increase uranium recovery.

There are many reasons for sorting, or preconcentrating, ore to be milled, but the primary one is to reduce overall production costs. This is normally accomplished by using sorting to increase the grade of ore, by discarding low grade ore and waste. The primary advantages include:

1. Reduced ore transportation costs — particularly where ore must be transported considerable distances, sorting at the mine site has the potential to greatly decrease transportation costs for a given amount of uranium output.

2. Increased mill utilization and lower costs — providing sorted, i.e. upgraded, ore for milling results in increased output. The higher grade throughput means lower extraction costs, or perhaps a smaller milling facility to achieve the same output.

3. Increased reserves — by relying on sorting to allow the mining of lower-grade ores (lower "cutoff" grade) a project's reserves can be expanded and the life of the project prolonged.

4. Lower reclamation costs — sorting can potentially decrease the quantities of tailings produced in the milling process.

Sorting Techniques

Throughout the history of mining, sorting has been used as the first step in the mineral processing sequence. With modernization, many mechanical and other types of sorting techniques have evolved to replace hand sorting, although hand sorting is still in use at various sites around the world.

Mechanization of the sorting process began with a variation on hand cobbing, by passing ore on a conveyor belt past rows of workers whose job was to accept or reject pieces of the ore or waste rock. The classic reference *Handbook of Mineral Dressing*, by Arthur F. Taggert (copyright 1927) states: "Labor is generally that unfit for any heavier work — boys, girls, women, or old or crippled men. Boys and girls are quicker and, if properly supervised, most satisfactory." From this point, more sophisticated sorting methods have been developed, based on radioactivity,

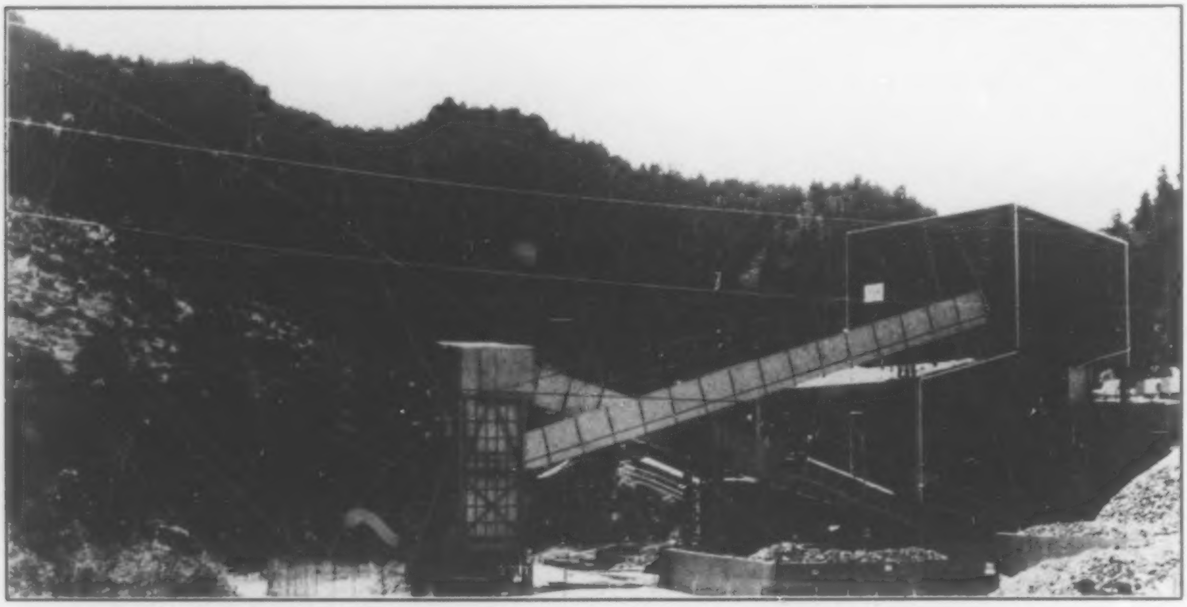

Figure 3. Ore Sorting Plant at the Schwartzwalder Mine, Golden, Colorado, USA.

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optical characteristics, specific gravity, magnetic properties, electrical conductivity, or color differences. For uranium mining, technology based on measurement of radioactivity appears to offer the most potential for fully automated sorting.

History of Radiometric Sorting

Canada's first uranium mine, the Eldorado mine at Port Radium on Great Bear Lake in the Northwest Territories, utilized hand sorting of high-grade uranium/silver ore as early as 1932, during the initial development of the mine. Subsequently, a 36-inch-wide (approximately 1 meter) sorting belt was incorporated into the mill, carrying plus-35mm (1.5-inch) material from a vibrating, heavy-duty screen (grizzly). The ore was sorted into a high-grade concentrate for direct shipment, and a waste product. Intermediate-grade material remaining on the belt was further processed by leaching to produce precipitated concentrate. A Geiger counter installed above the belt aided the sorting.

By the late 1940s, a device called the Lapointe Picker had been developed in Canada and incorporated the principles upon which today's radiometric sorters are based. The Lapointe unit used Geiger counters to measure gamma emissions from individual rock pieces moving above the counters on a conveyor belt. A drawback to this device was the inability to measure mass of the rocks. In other words, while it was able to measure radioactivity, the machine could not differentiate between a small high-grade rock and a large low-grade rock, and so could not establish a relative radiation level that would provide a more precise basis for selection. This drawback was partially overcome by carefully controlling the size of the feed, even using several of the machines, each sorting different sizes, calibrating them accordingly. The units also encountered problems in positioning the individual ore pieces for reading by the Geiger counters. These early sorters used horizontal pneumatic rams to push larger-sized pieces of the accepted ore from the conveyor belt. Ore particles smaller than approximately 50 mm (2 inches) in diameter were separated by air jets blowing across the conveyor belt.

By 1958, a sorting unit developed by L. Kelly and J. Hutte, called the K and H Model 6, had been installed in Canada at the Bicroft Uranium Mines Ltd. in southeastern Ontario near Bancroft, about 150 miles northeast of Toronto. Kelly and Hutte were employees of Bicroft in the positions of Chief Geologist and Chief Engineer, respectively.

Sorting with the K and H device occured during free fall of the ore from the end of the conveyor belt. Each piece passed a scintillation counter which fed readings to an electronic control system which, in turn, regulated a series of air jets located 18 inches below the counter. Under this system, waste was rejected and ore was allowed to fall freely.

Ultimately, the K and H sorter incorporated several essential improvements, particularly in feed presentation and in the measurement of particle size. The rock was fed into the sorting machine from a surge bin via a conical-shaped rotating feeder, which positioned the ore pieces individually on the conveyor belt. The belt then accelerated the rock to about one meter per second. A light source coupled with a photoelectric cell measured each particle's approximate cross-sectional area while in free-fall, and just below it, a radiation detector measured radioactivity. Feed ranged in size from approximately 50 to 300 mm (2 to 12 inches), and maximum sorter capacity was about 25 tons per hour of plus-75 mm (3 inch) material. In 1960, six of the K and H sorters were installed at the Mary Kathleen Uranium Ltd. Mill in Queensland, Australia. Others also were installed at the Eldorado Mining and Refining Ltd. Beaverlodge Mill in Canada's Northwest Territories.

After the operation of K and H equipment at the Mary Kathleen Mine had proved highly successful, the mine owners, Conzinc Rio Tinto of Australia Ltd., bought the Canadian company, along with a South African firm building sorting equipment under license, forming Ore Sorters Ltd. as a subsidiary of Rio Tinto Zinc Corporation (RTZ). The new company began to make additional refinements to the concepts originally developed by K and H for sorting according to radioactivity, and also developed optical sorting devices.

Another company, Sortex, a subsidiary of Gunson Ltd. of the U.K., also began development of radiometric sorting equipment. Gunson had been supplying automated seed and other foodstuff sorting machinery since the 1940s, as well as supplying sorting equipment to the diamond industry in South Africa. It has been reported that four Gunson Sortex radiometric sorters were sold to the Bufflesfontein Gold Mining Company of South Africa in 1980. Subsequently, this division of Sortex was bought by Ore Sorters, making Ore Sorters the only free-world supplier of radiometric sorting equipment.

At present, units supplied by Ore Sorters have been installed in several working uranium mines, and come in

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several configurations, with varying capacities and other features that accommodate specific mining conditions. The company's manufacturing plant is located at Wynburg, near Johannesburg, South Africa.

Sorting Technology

Radiometric sorting systems almost invariably are placed following the primary crushing process and incorporate a washing/screening operation to eliminate fines from the sorter feed. In addition, all radiometric sorters rely on certain similar subsystems, including:

1. A means of distributing particles separately on a feeder line (ore presentation, Figures 5 and 6);
2. A detection system, which differentiates individual particles, measuring their size (or mass) and radioactivity levels (sensing, Figure 4);
3. A system to eject, or split the ore stream into accepted or rejected fractions (separation); and
4. Electronic coordination of the detection system with the ejection system (electronic processing);

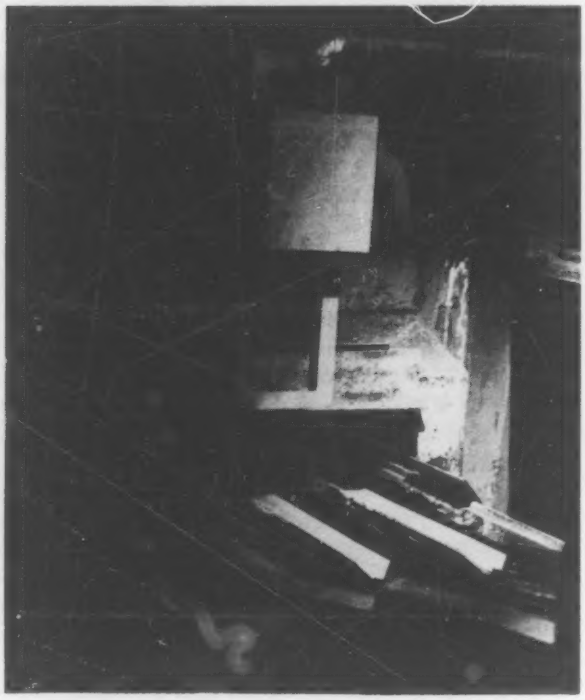

Figure 4. Ore Sorter Radiation Measurement Unit at the Schwartzwalder Mine.

Proper particle distribution along a moving belt is a critical part of the sensing process. Not only must the particles be fairly evenly distributed at an optimum distance apart, but they must be accelerated to a certain velocity so that when they leave the end of the feeder belt, their trajectory is such that they can be deflected by air jets into one of two piles. For radiometric sensing, the rocks must be positioned in single file, not in a random sequence, for reading by the radiation detection equipment and the optical size detectors, which together determine rejection or acceptance. The speed of the particles on the belt is precisely correlated with the sensing devices, and rock position must be effectively stabilized while on the belt. In most sorters, a surge bin or feeder belt feeds the ore into channels on the scanning belt; its acceleration to around 5 meters per second causes the particle spacing to increase.

All radiometric sorters have measured particle radiation with scintillation counters ("scints"). While the early K and H sorters measured particle radiation as the rock piece was falling free after leaving the conveyor belt, current practice, as used in the Ore Sorters Model 17 unit, is to place the scints below the moving belt. Different arrangements of sensors are used depending on the rock sizes being measured. Lead shielding around the scints prevents outside radiation interference. Depending on the actual equipment used, an ore particle may pass over as many as sixteen scints, which register and total the radiation count before it is collated by the central processer.

One of the problems with early sorting technology was the crude, or nonexistent, determination of particle mass. Without a reasonably accurate mass determination, the gross radiation count could not be precisely correlated with rock size to give a true evaluation of ore grade. Again, using the Ore Sorters Model 17 as an example, mass determination is now performed by a row of photodiodes that measure the size of a shadow cast by a light source as the rock piece moves past the sensors while in free fall.

Input data, such as the values for radioactivity, estimated particle size, and belt speed, are stored in the sorter's computer processor, where the decision is made to accept or reject the particle, based on a predetermined grade cutoff level. The computer then relays instructions to a blasting manifold that directs compressed air at the computed location of the particle to be blasted.

The blast of air determines the trajectory taken by the particle leaving the moving belt, directing it to one side of a splitter or the other. The sorter can be directed to blast either an accepted or rejected fraction, depending on which

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is more economical. Normally, the smallest fraction of the ore (whether accepted or rejected) is the one blasted.

At the present state of development, certain physical limitations hinder the application of sorting equipment. In particular, the size of ore particles must fall within certain limits, generally between 25 and 160 mm (1 to 6 inches), and the different particles must exhibit a reasonable variation in uranium grade.

Sorting machines are available having several different configurations with regard to numbers of channels and capacities of ore. For higher capacities and larger particle sizes, a two channel configuration might be appropriate, with a throughput of about 120 tons per hour. For smaller particle sizes, perhaps in the 25 to 50 mm range, a three, four or five channel system with a throughput of perhaps 50-70 tons per hour might be better suited. The costs of the various configurations are roughly the same.

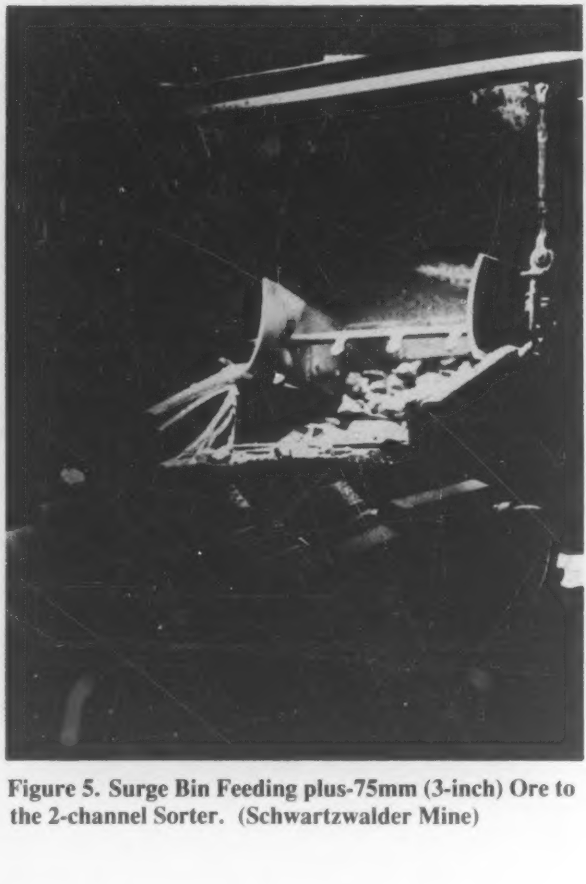

Figure 5. Surge Bin Feeding plus-75mm (3-inch) Ore to the 2-channel Sorter. (Schwartzwalder Mine)

Figure 6. Part of 6-Channel Sorter, Used for 25 to 75-mm (1 to 3-inch) Ores. (Schwartzwalder Mine)

Suitability of Ore for Sorting

The physical characteristics of an ore determine its suitability for sorting and greatly affect the efficiency of the sorting procss. These characteristics include the ore's resistance to breakdown into "fines" and radiological contrast between particles. Visualize, if you will, a barrel filled with a mixture of large, black, heavy marbles and small, white, lightweight cubes. Obviously, such a mixture could be quickly sorted into its components by any of several means, with little or no residual intermingling. As the similarity between components to be sorted increases, the separation becomes more difficult and residual intermingling increases. Residual intermingling is the measure of the efficiency of the sorting process and may be thought of as the combined percentage of misplaced material.

Typically, uranium ores are sorted on the basis of the

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amount of radiation emitted per unit of mass, i.e. its radiometric grade. Thus, the sorting system must be capable of measuring both radiation and mass. To date, all radiometric sorters have used indirect methods to accomplish this. Grade measurements are indirect in the sense that radiation is assumed to be directly proportional to uranium content. The assumption, however, may be far from accurate for many individual rocks, particularly in sandstone deposits, as well as in certain others.

This departure from direct proportionality (equilibrium) is termed disequilibrium and is caused, generally, by preferential leaching or deposition of some or all of the uranium decay products associated with the original deposit. These products of uranium decay are the primary emitters of the gamma radiation which serves, typically, as a measure of the quality (grade) of uranium ore. Most of the gamma-ray emission of uranium ore can be attributed to Thorium 234, Lead 214 and Bismuth 214. When the rate of formation of these elements is not equal to the decay rate, the deposit is not in "equilibrium" and the quantity of uranium present is not proportional to the radiation emitted. In such cases, a radiation scanner is unable to sort effectively.

The determination of mass (or weight) is also indirect. Most current systems utilize a light source and an array of photocell detectors to measure the shadow produced and hence to estimate the size or volume of each particle. For ore of constant density, the method provides sufficient definition. For ore with varying density (in many cases, density varies with grade), the process is less effective.

The physical act of transporting and handling ore generates a substantial amount of fine particles through attrition. Most sorters can handle a size range of between 25 to 150 mm (1 to 6 inches); for purposes of definition, fines are considered as being less than 25 mm (one inch) in size. Since sorter capacity is a function of pieces throughput per unit of time, a given machine can sort more tonnage per unit of time when sorting larger material. Ores which are resistant to breakdown from abrasion may, therefore, be more efficiently sorted.

Sandstone uranium ores tend to be friable and to contain clay. They break down easily when handled (an advantage for conventional milling operations) or when exposed to air and water. The clay content, which can cause a variety of handling and treatment problems for conventional mills, also can cause major problems for sorting, especially in the screening/washing sequence. Overall, sandstone ores, which comprise over 90 percent of the world's uranium resources, are not particularly suitable for sorting.

Ores which exhibit a wide range of uranium content are more amendable to efficient sorting than those with a narrow range, because the wider range provides a greater contrast. Particular difficulties are encountered if a large percentage of the ore is near cut-off grade. In this case, minor deficiencies in the sorting process could lead to greatly increased residual intermingling.

Projects Using Radiometric Ore Sorting

Australia

The Mary Kathleen Mine — The Mary Kathleen mine was located 40 miles east of the mining town of Mt. Isa in western Queensland. Uranium deposits of this area occur as ore shoots in massive garnet diopside which is hard, abrasive and dense. The uranium mineralization is pitchblende in allanite and varies in thickness from a few centimeters to several meters.

The original sorting installation at the Mary Kathleen consisted of five Model 6 sorters of the early K and H type. These sorters were installed in 1960. In 1979, two Model 17 sorters were added in order to increase throughput and reduce uranium loss to rejects, particularly in the finer material. Mined ore grade averaged about 0.10 percent U_3O_8. After crushing, the plus 100 mm (4 inch) material was washed to remove fines and then sorted. By rejecting about 20 percent of the feed, the average mill head grade was raised by about 10-15 percent The grade of the material actually sorted was raised by about 50 percent.

The Mary Kathleen mine operated from 1958 through 1963 and from 1974 to 1982. The plant had a design capacity of 3,000 tonnes per day of mine-run ore. The entire operation has been decommissioned and reclaimed to the extent that the Queensland government has now accepted termination of the mining leases and has assumed full responsibility for any long-term effects.

Canada

Bicroft — The uranium-bearing rocks of the Bancroft area occur in pegimatitic granite dykes, the only such economic occurence in pegmatites in Canada. Uranium deposits of the district are generally of low grade. In 1981, the average grade of Bancroft area reserves was estimated to be 0.11 percent U_3O_8. Uranium occurences in pegmatites are notably irregular and, given the general hardness of pegmatites, provide an ideal setting for the sorting process.

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RAW MATERIALS

The K and H sorter installed at the Bicroft mill in 1958 sorted plus 75mm (3-inch) material at a rate of 20 tons per hour. After crushing, screening and washing, the ore was fed onto a conveyor belt traveling at about 1 meter per second. The mine's average feed grade was 0.03 percent U_3O_8, and the sorter rejected 65 percent of the feed with an average grade of 0.011 percent U_3O_8. The remainder of the ore was upgraded to 0.065 percent U_3O_8. This sorter was set to blast waste even though the majority of the feed was waste. The reason for blasting the waste fraction instead of the accepted ore was to maximize uranium recovery. The overall uranium recovery was about 75 percent.

Total mill operating costs were reported to be C$3.662 per ton of ore for the period January to June 1958. Updated to 1987 Canadian dollars through the Industry Selling Price Index, 1987 costs would be about C$14.80 per ton. At a rejection rate of 13 tons per hour, the annual savings could be substantial. Actual savings are difficult to calculate since sorting costs are included in the total milling cost and since fixed and variable costs, pre- and post-installation recoveries and the time value of money all affect the calculation.

France

Lodeve — At Lodeve, in the south of France, Cogema installed a radiometric sorter at its existing plant in 1985. The ore is described as a highly-compacted, fine, detrital sandstone with an average grain size of 60 microns. Mineralization may occur either as fracture filling or as large zones within more permeable beds.

The Lodeve sorter is a four-channel unit which rejects about 20 percent of its throughput. Feed to the sorter ranges in size from minus 90 mm (3.5 inches) to plus 30 mm (1.25 inches). Rejected grade is about 0.04 percent U_3O_8. The average mined ore grade is 0.30 percent U_3O_8.

South Africa

Radiometric ore sorting has been applied at several gold mining operations in South Africa where the gold content of the ore is roughly proportional to the uranium content. These ores occur as thin, extensive "reefs" of hard quartz-pebble conglomerates. The primary objective of the sorting process is, however, to increase the gold grade. Uranium is usually a by-product, the sale of which might account for some 5 to 20 percent of the total revenue. Uranium recovery follows gold recovery by leaching of the finely-ground residual material. The Bufflesfontein plant, for example, has a total throughput of about 260,000 tonnes of ore per month, after sorting. Prior to the installation of a sorting plant, hand sorting was utilized to reject about 20 percent of the mine run ore. The sorting plant consists of four six-channel sorters which are designed to reject material grading less than 0.0025 percent U_3O_8.

The Hartebeestfontein mine produces some 4,000,000 tonnes of ore per year, of which in 1987 some 23 percent was rejected by the sorting plant. As direct mill operating costs amount to R 8.50 (US $4.25) per tonne of ore milled, the potential for cost reduction or for increased throughput of more profitable ore can be substantial.

USA

The Schwartzwalder Mine - Cotter Corporation, a subsidiary of Commonwealth Edison, operates the Schwartzwalder uranium mine which is located in the foothills of the Rocky Mountains about 25 miles west of Denver, Colorado (See Figure 3 at the beginning of this article). Ore is sorted at the mine and is trucked some 110 miles (180 km) to Cotter's mill at Canon City, Colorado. Thus, transportation savings are a major factor in the sorting economics.

Uranium mineralization at the Schwartzwalder occurs primarily in fissure veins along faults and fractures in metasediments and crystalline rocks. Disseminated mineralization in pegmatite dikes is of minor importance. The principal uranium minerals are pitchblende and coffinite. The ore is relatively hard but does have a tendency to break into fines; the waste is less brittle. As a result, recovered grade is not greatly reduced by allowing the fines to bypass the sorter and go directly to the ore stockpile.

Two radiometric sorters were installed in 1977; a three-channel and a six-channel unit. The three-channel unit is used for larger particles (50 to 150 mm) and the six-channel unit is used for smaller (25 to 50 mm) sizes. These units have accumulated 63,000 and 28,000 operating hours, respectively, since installation. Maximum throughput was 130,000 short tons in 1979.

Historically, the Schwartzwalder mine has produced a mine-run grade of about 0.30 percent U_3O_8, which has been upgraded by sorting to about 0.50 percent U_3O_8. The reject rate has been about 30 percent of throughput when sorting out rock of 0.02 percent U_3O_8 or less. More recently, both the mine-run grade and sorted grade have been increased in order to cope with falling prices.

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Energy Fuels — Energy Fuels Nuclear Corp. has used a portable radiometric ore sorter on low-grade material stockpiled at its breccia-pipe Hack Canyon mine near the Grand Canyon in Arizona. In this case, the ore is a cemented breccia of various sediments including sandstones, shales, and limestones. Mineralization tends to be concentrated in the more porous hosts. The Energy Fuels operation is notably remote (300-plus miles) from the mill at which the ore is processed; thus, substantial transportation savings are a potential result of sorting. It may be speculated that sorting could be applied to other uranium deposits, developed or undeveloped, which are remote from a mill. In this way, potential licensing problems for a new mill can be minimized or avoided.

Sorting Economics

The primary benefits of sorting may be seen in reduced costs for mill operation and transportation. Sorting may also provide opportunities for increased mill output, longer project life, lower reclamation costs and increased mill recovery. Certain of these benefits could easily be additive and may provide new perspectives for a number of uranium deposits.

Mill Operating Costs

The recovery of uranium from mined ore normally requires a series of unit process operations including crushing, grinding, leaching, liquid/solid separation, precipitation and waste disposal. The cost of most of these operations depends on the tonnage of ore treated, not on the quantity of uranium recovered. These costs are composed of two elements: fixed items which are more or less independent of throughput, such as labor, and variable items such as chemicals and power supplies, which are directly dependent upon throughput.

Fixed costs may amount to about 40 percent of direct operating costs. Thus, if mill throughput could be reduced 25 percent by sorting, the total mill operating cost might be reduced by 15 percent (60 percent x 25 percent). This reduction would be offset, to some degree, by the operating cost of sorting, which has been estimated to be in the range of $1.00 per ton of feed. Thus, for mills with operating costs greater than $7.00 per ton ($1.00/0.15), sorting may offer an economic advantage.

This operating cost advantage must, of course, be weighed against the cost of purchasing and installing the sorter. The process of comparing reduced operating cost against a capital cost usually requires the development of a series of cash flows which may be discounted through time to reflect the cost of money. Decreased overall recoveries must also be considered since some potential product is discarded during the sorting process. Mill operating costs in the western USA range from about $15.00 to $35.00 per ton of ore.

Transportation Costs

The economic impact of sorting on long-distance transportation costs is relatively easy to define. Truck transportation costs in the western USA typically are in the range of $0.08 to $0.12 per ton-mile for highway haulage. Thus, if the combination of distance and cost per ton-mile exceeds the operating cost of the sorting unit, some benefit may be gained, provided that sufficient tonnage is available to offset the cost of purchasing and installing the sorter. Again, sorting losses and the time value of money play a role in the overall analysis.

Mill Size

For new operations, a sorting unit could reduce the size of the processing facility required. A new 1,000 ton per day capacity uranium mill built in the western USA today might cost, for example, $35 million. If the same output could be achieved by a smaller mill (by feeding higher-grade, sorted ore), significant savings in construction costs could result. Table 1 shows an estimate of these savings in relation to decreased capacity. These potential savings can be compared to the cost of purchasing and installing a sorter, which by some estimates might be in the range of $1.5 million.

Looking at mill sizing from the perspective of increased output, the results could be even more significant. Suppose, for example, that a sorter rejecting 20 percent of the mill feed increases the grade of the feed by 25 percent. Mill output and revenue would be increased by 50 percent.

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Table 1

RELATIONSHIP OF SORTED FEED TO POTENTIAL MILL CONSTRUCTION COST SAVINGS

Percent Feed Sorted and Rejected	Construction Cost Savings ($Millions)
5	1.1
10	2.1
15	3.3
20	4.4
25	5.6

Conclusion

The production cost savings potentially available through use of radiometric sorting of uranium ore are substantial, but many ores, especially most sandstones, are not well suited to sorting. Installing a sorting plant is not cheap — between one and two million dollars including purchase, setup, and the necessary modifications to an existing plant. Sorting technology continues to evolve, however, toward the capability of handling smaller particles and evaluating their grade more accurately. Sorting plants are likely to plant an increasing role in the future development of the uranium industry.

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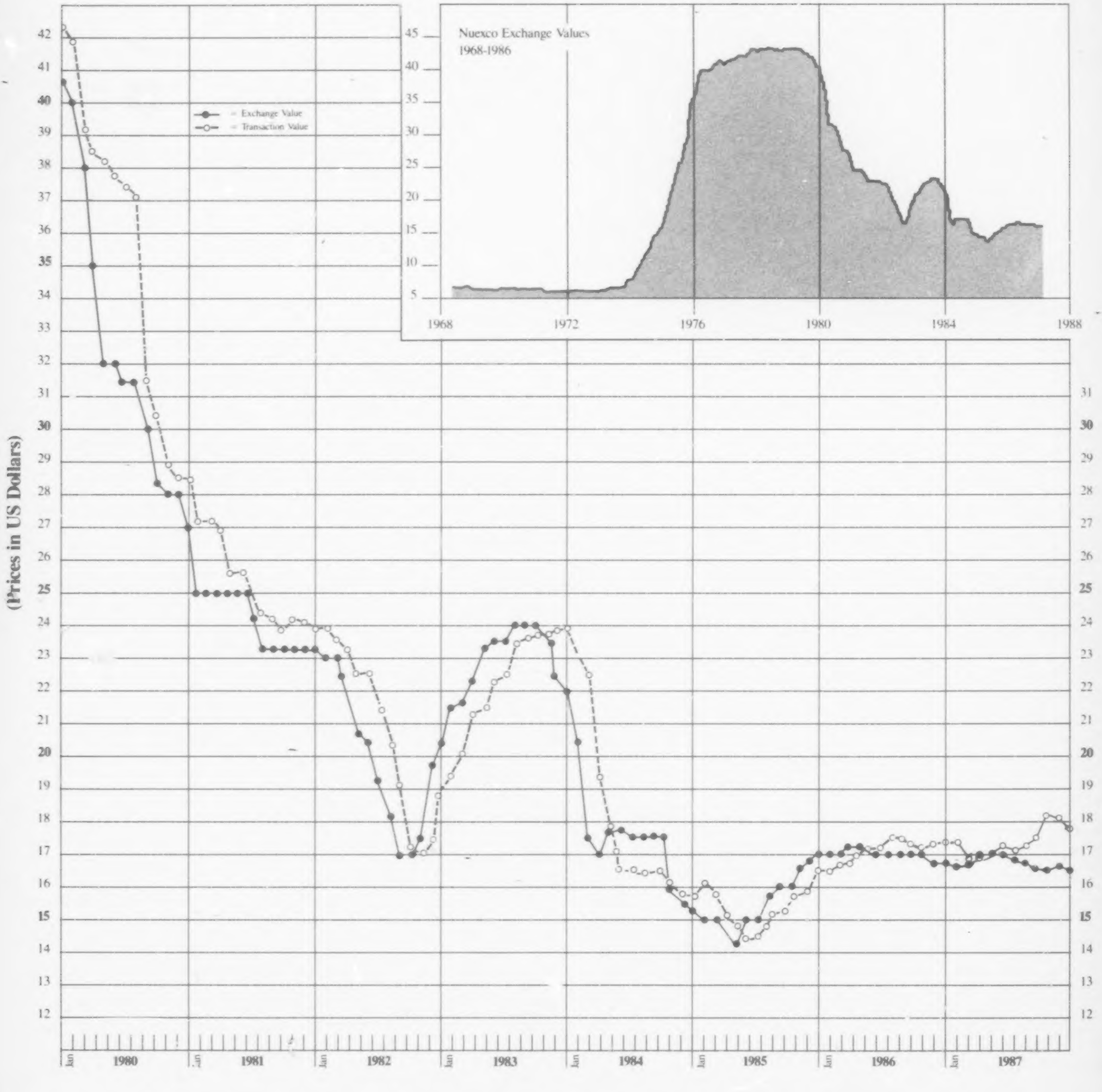
HISTORICAL MARKET DATA



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969		6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	**16.65**	

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	**17.80**	

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HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	**1.90**	

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated (US Dollars/kg. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	**47.00**	

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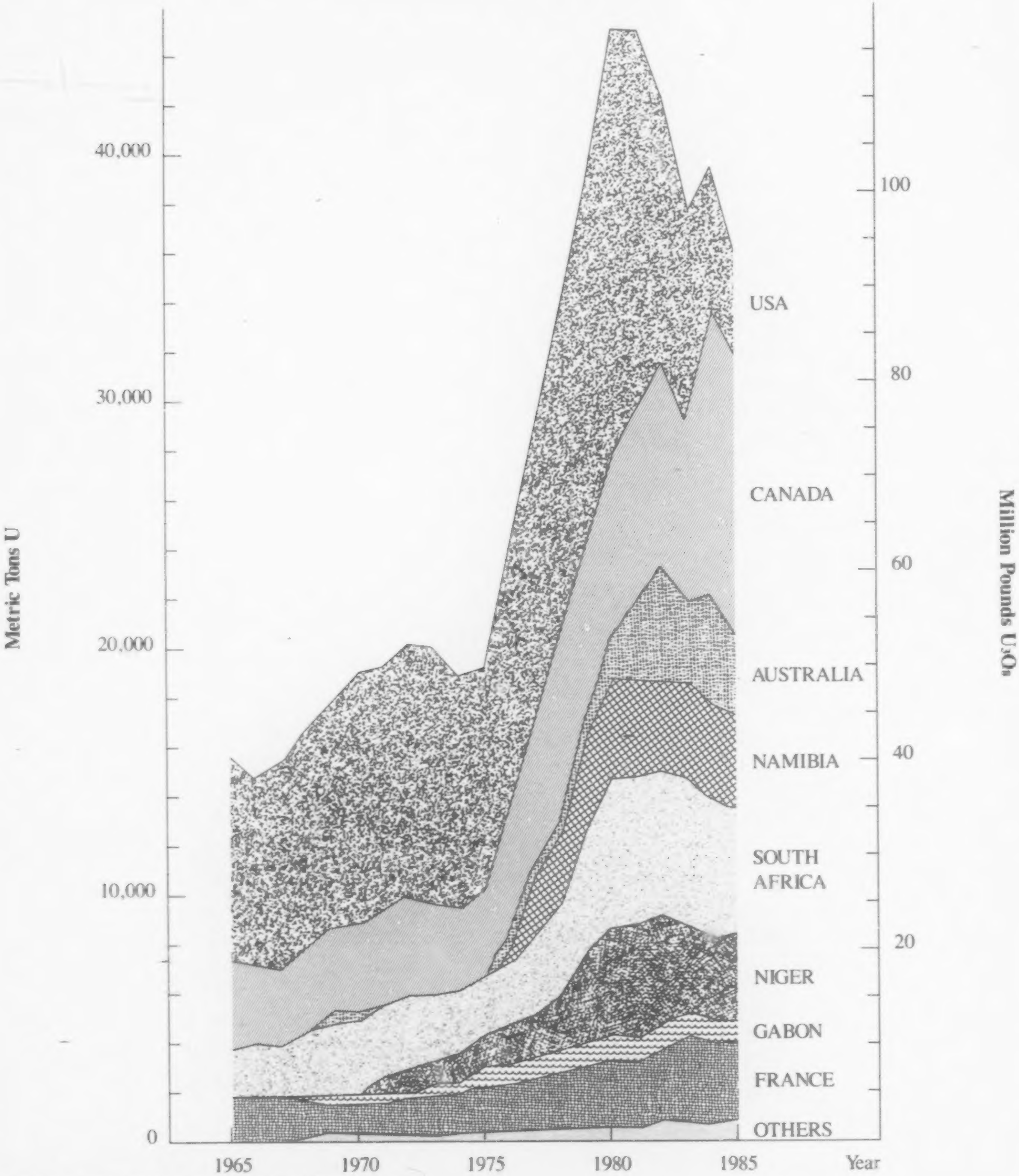
HISTORICAL MARKET DATA

HISTORICAL WOCA[1] URANIUM PRODUCTION[2]
(Compiled by OECD/IAEA Joint Report[3])



[1] WOCA = World Outside of Centrally-planned Economic Areas.
[2] 1985 production data are preliminary.
[3] A joint report issued biennially by the OECD Nuclear Energy Agency and the International Atomic Energy Agency.

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US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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HISTORICAL MARKET DATA

VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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AUSTRALIA

		Consumer Price Index[1]	Price Index of Materials Used in Manufacturing Industry — All Groups[2]	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (1976=100)
1975	Avg.	57.9	150.4	132.6
1976	Avg.	65.7	168.4	160.9
1977	Avg.	73.8	192.0	179.0
1978	Avg.[4,5]	79.7	198.5	190.0
1979	Avg.	86.9	248.8	127.9
1980	Avg.	95.8	321.8	140.8
1981	Avg.	105.0	355.3	154.1
1982	Avg.[6]	116.7	368.6	174.9
1983	Avg.	128.5	401.6	181.9
1984	Avg.	133.6	95.3	194.4
1985	Avg.	142.6	100.0	202.7
1986	Avg.	155.5	105.0	212.9
Jan	1986	—	109.5	210.5R
Feb	1986	—	108.7	210.5R
Mar	1986	150.5	99.4	210.5
Apr	1986	—	94.2	210.5
May	1986	—	93.5	210.5
Jun	1986	153.0	95.6	210.5
Jul	1986	—	97.8	215.3
Aug	1986	—	97.9R	215.3
Sep	1986	157.0	105.4	215.3
Oct	1986	—	105.9	215.5R
Nov	1986	—	104.9	215.7R
Dec	1986	161.5	105.2R	215.6
Jan	1987	—	106.2	215.9R
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2R
Apr	1987	—	108.3	222.1R
May	1987	—	108.1	221.9R
June	1987	167.2	108.1	221.2R
July	1987	—	108.7	222.5R
Aug	1987	—	110.5	223.2R
Sep	1987	170.0	—	223.3

P = Preliminary R = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: year 1980-81=100.0). Index periods are for normal calandar years; figures shown at tnd of year represent yearly average; figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. the previous index was 1969 = 100.

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Annual Averages are for financial year ending June 30.

[5] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[6] Monthly data for 1979-82 appear on page 35 of Report 184.

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CANADA

			Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Industry Products Price Index: All Commodities[1] (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979	Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980	Avg.	247.2	—	10.58	10.80	—	—	8.50
1981	Avg.	288.7	—	12.02	12.23	—	—	9.53
1982	Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983	Avg.	298.8	—	—	14.30	—	—	11.17
1984	Avg.	310.9	17.88	—	—	—	—	—
1985	Avg.	118.58	18.52	16.37	15.65	12.75	11.19	12.20
Jan	1986	121.0	18.15	16.22	15.86	13.11	11.48	12.52
Feb	1986	120.8	19.52	16.57	15.99	13.20	11.59	12.45
Mar	1986	120.1	19.04	16.65	15.93	13.11	11.59	12.54
Apr	1986	119.3	19.38	16.68	15.95	13.07	11.64	12.54
May	1986	118.4	19.54	16.68	15.78	13.16	11.72	12.51
Jun	1986	118.6	19.80	16.63	15.64	13.44	11.86	12.49
Jul	1986	118.8	19.51	16.34	15.48	13.28	11.73	12.52
Aug	1986	119.1	18.39	16.17	15.46	13.31	11.31	12.70
Sep	1986	119.4	19.32	16.62	15.78	13.14	11.45	12.90
Oct	1986	119.9	19.97	16.81	16.11	13.30	11.59	12.94
Nov	1986	119.9	20.11	17.01	16.24	13.42	11.66	12.93
Dec	1986	119.7	19.67	16.79	16.19	13.06	11.57	12.99
Jan	1987	120.0	19.53	16.93	16.01	13.06	12.58	12.89
Feb	1987	119.8	20.33	17.20	16.21	13.01	12.66	13.11
Mar	1986	120.4	20.04	17.14	16.15	13.57	12.58	13.02
Apr	1987	121.2	20.47	17.38	16.26	13.75	11.99	13.27
May	1987	122.0R	20.50	17.12	15.96	14.23	11.44	13.19
June	1987	122.5	20.23	16.94	15.70	13.65	12.77	12.88
July	1987	123.1	19.75	16.73	15.63	13.90	12.52	12.98
Aug	1987	123.7	19.64R	16.98R	15.87R	13.99R	12.65R	13.03R
Sep	1987	124.0	18.66P	17.17P	16.19P	13.71P	12.52P	13.28P
Oct	1987	124.3	—	—	—	—	—	—

P = Preliminary   R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-0II). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (3Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)"Æ Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, plus a random
survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data. Wage Earner Data were further revised in January 1987 and now reflect a slightly different base than previously.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI data for I977 and I978 appear on page 4.I0 of Report I38, and monthly wage-earner data for I973-78 appear on page 4.II of Report I38.

[7] Monthly data for I979-1982 appear on page 37 of Report I84. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)".

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.[7]	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.88	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
1985	Avg.	68.76	151.68	192.6	181.2	726,804	396,956
Jan	1986	—	—	213.8	203.6	744,070	449,513
Feb	1986	—	—	215.8	206.9	754,458	438,562
Mar	1986	75.76	167.8	218.3	206.9	759,897	445,387
Apr	1986	—	—	222.2	208.9	756,388	437,563
May	1986	—	—	222.6	212.5	754,788	425,544
Jun	1986	77.65	172.0	224.4	213.3	756,637	462,365
Jul	1986	—	—	228.8	216.3	756,140	516,832
Aug	1986	—	—	232.2	220.3	760,929	502,968
Sep	1986	81.94	181.8	236.7	221.9	765,772	511,363
Oct	1986	—	—	239.3	226.8	763,953	512,897
Nov	1986	—	—	242.4	230.2	761,325	531,509
Dec	1986	85.38	189.9	244.9	232.1	752,264	536,970
Jan	1987	—	—	248.3	233.9	740,031	532,577
Feb	1987	—	—	251.0	237.0	757,872	598,986
Mar	1987	88.17	197.1	255.0	239.6	762,697	536,006
Apr	1987	—	—	258.2	242.5	761,850	533,487
May	1987	—	—	261.2	243.6	759,421R	530,981
Jun	1987	90.74	203.5	263.1	244.9	759,433	573,546
July	1987	—	—	266.2	246.8	681,409	566,232
Aug	1987	—	—	270.0	249.9		
Sep	1987	100.79	224.7	273.4	252.4	—	—

P = Preliminary R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria: "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

GOVERNMENT STATISTICS

UNITED STATES

		Producer Price Index[1]					Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]		
		Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3,4] (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.[6]	274.8	268.8	246.8	85.7	10.26	10.63	8.30	6.94
1981	Avg.	304.1	293.4	272.4	94.0	11.55	11.98	9.12	7.62
1982	Avg.[7]	312.3	299.3	289.1	100.0	12.31	12.93	9.96	8.21
1983	Avg.	315.7	303.1	298.4	103.9	12.58	13.43	10.59	8.65
1984	Avg.	322.6	310.3	311.1	107.7	13.05	13.43	11.08	9.04
1985	Avg.	323.8	308.7	322.2	111.2	13.38	13.74	11.56	9.46
1986	Avg.	312.2	299.8	328.4	114.1	13.20	13.49	11.98	9.65
Jan	1986	323.8	308.9	328.4	—	13.41	13.68	11.87	9.58
Feb	1986	318.9	304.4	327.5	—	13.46	13.80	11.83	9.57
Mar	1986	314.0	300.3	326.0	112.9	13.41	13.91	11.80	9.60
Apr	1986	311.6	298.2	325.3	—	13.47	13.89	11.84	9.60
May	1986	311.6	299.2	326.3	—	13.40	13.79	11.90	9.63
Jun	1986	311.8	299.0	327.9	113.7	13.50	13.50	11.95	9.59
Jul	1986	308.5	297.4	328.0	—	13.33	13.30	12.05	9.67
Aug	1986	307.9	297.2	328.6	—	12.96	13.13	11.99	9.64
Sep	1986	308.7	297.5	330.2	114.7	13.04	13.28	12.03	9.70
Oct	1986	309.6	298.4	330.5	—	12.85	13.16	12.08	9.67
Nov	1986	309.8	298.7	330.8	—	12.75	13.14	12.17	9.73
Dec	1986	309.8	298.1	331.1	114.9	12.70	13.03	12.20	9.82
Jan	1987	313.5	300.9	333.1	—	12.94	12.98	12.18	9.84
Feb	1987	314.9	302.2	334.4	—	12.99	12.83	12.21	9.84
Mar	1987	315.7	302.7	335.9	116.1	13.04	12.79	12.24	9.84
Apr	1987	317.3	305.0	337.7	—	13.16	12.90	12.30	9.82
May	1987	318.3	307.1	338.7	—	12.97	12.92	12.31	9.83
Jun	1987	319.9R	308.2R	340.1	117.2	13.05	12.93	12.27	9.84
Jul	1987	322.6	310.2	340.8	—	13.06	13.07	12.37	9.89
Aug	1987	323.8	310.5	342.7	—	13.03R	13.07P	12.34R	9.90
Sep	1987	323.3	310.4	344.4	117.8	13.21P	13.54P	12.56P	9.98P
Oct	1987	324.9	311.4	345.3	—	—	—	12.49P	9.96P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28 and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139. Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147. Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154. Monthly Data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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NUEXCO

Monthly Report

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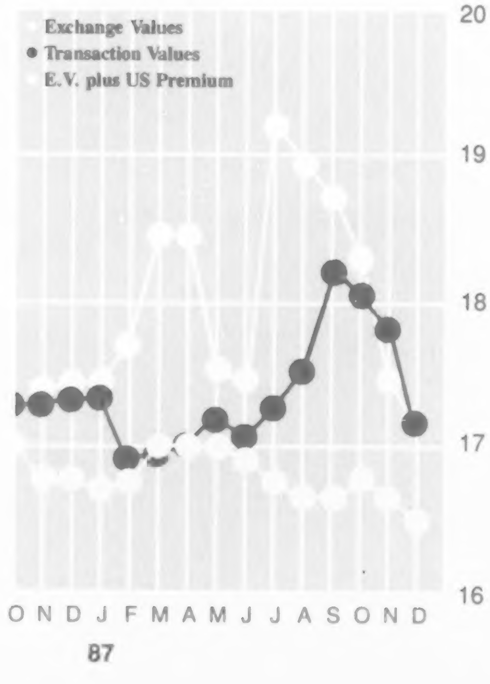
DOE Declares US Uranium Industry Non-Viable for 1986 22



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NUEXCO

EXECUTIVE SUMMARY
REPORT 233
(All data as of December 31, 1987)

Exchange Value
$16.55, down $0.10

The **Exchange Value** is **$16.55** per pound U_3O_8, down $0.10 since last month. The US Premium (relative to the Exchange Value) is $0.65, down $0.20 since last month.

UF_6 Value
$47.00, unchanged

The **UF_6 Value** is **$47.00** per kilogram U as UF_6, unchanged since last month. The US Premium (relative to the UF_6 Value) is $2.00, down $0.25 since last month.

Transactions

Fourteen recent natural uranium sales are reported, involving **7.0 million** pounds equivalent U_3O_8. Eight of the sales involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. In addition, six long-term uranium sales are reported. Active spot and near-term **uranium supply** amounts to **4.8 million** pounds U_3O_8 equivalent, down 2.1 million pounds since last month. Active spot and near-term **uranium demand** totals **2.4 million** pounds, up 1.1 million pounds from last month. The spot and near-term **supply-demand ratio** decreased to **2.0 to 1**.

Transaction Value
$17.20, down $0.60

The **Transaction Value** is **$17.20** per pound U_3O_8, **down $0.60** since last month. The calculation includes transactions involving a total of 3.9 million pounds U_3O_8 and equivalent UF_6, of which 1.6 million pounds are US-origin, and covers a period of 3 months.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged. No loan transactions are reported.

Conversion Value
$1.90, unchanged

The **Conversion Value** is **$1.90** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 700 thousand pounds U as UF_6. Active demand totals 320 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for delivery within one year: $73, unchanged

The **SWU Value** at .3% tails assay and for delivery within one year is **$73** per SWU, unchanged since last month. One secondary market SWU transaction is reported.

* * *

Raw Materials

1987 US uranium production declined approximately 10 percent since 1986, to approximately 12.5 million pounds U_3O_8. This decrease was largely the result of lower production at the Umetco/Energy Fuels White Mesa mill in Blanding, Utah, the shift from production to restoration at USX's south Texas solution mining operations, and the suspension of production at Cotter Corporation's Schwartzwalder mine in Colorado.

United States

The US Energy Information Administration (EIA) has released its annual viability assessment study of the US uranium industry, for the calendar year 1986. Overall, the EIA study showed the industry to be little changed from the previous year, in which it was found non-viable, although several of the indicators showed more positive results. Following the release of the EIA study, Secretary of Energy Herrington declared the industry non-viable for 1986.

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NUEXCO REPORT 233 FIGURES OF THE MONTH (December 31, 1987)	This Month (Report 233)	Last Month (Report 232)	12 Months Ago (Report 221)
Exchange Value (\$US per pound U_3O_8)	16.55	16.65	16.75
US Premium for the Exchange Value (\$US per pound U_3O_8)	0.65	0.85	0.75
UF_6 Value (\$US per kilogram U as UF_6)	47.00	47.00	47.75
US Premium for the UF_6 Value (\$US per kgU as UF_6)	2.00	2.25	2.50
Transaction Value (\$US per pound U_3O_8 equivalent)	17.20	17.80	17.35
Loan Rate (Per Annum)	3.5%	3.5%	4%
Conversion Value (\$US per pound U as UF_6)	1.90	1.90	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	4,750	6,845	4.1
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	2,395	1,275	0.8
Near-Term Supply-Demand Ratio	2.0	5.4	5.2
Recent Uranium Sales:[3]			
Number of Transactions	14	9	1
Quantity of Material (Millions of pounds U_3O_8 equivalent)	7.0	1.8	0.1 - 0.3
Nuexco SWU Value: (\$US per SWU):			
at 0.3 tails assay	73	73	80
US DOE SWU Prices: (\$US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6[8]: (\$US per kgU as UF_6)			
2.5 w/o U_{235}	439	441	459
3.0 w/o U_{235}	562	563	588
3.5 w/o U_{235}	686	688	719
4.0 w/o U_{235}	812	814	852

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[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

January 1987 No. 233

R. GENE CLARK, *EDITOR* CHARLES B. LEWIS, *ASSISTANT EDITOR*

PRICING

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To Our Readers

* * *

Activities of Nuexco's International Advisory Committee

Nuexco's International Advisory Committee has met formally at various times in London, Geneva, Tucson, Washington D.C. and Stockholm. Future meetings are being planned for Tokyo, Toronto, and Johannesburg, with additional sectional meetings in other locations.

Mr. Lee Erdahl has elected to leave the International Advisory Committee at the end of his current term, December 31, 1987. Lee served, until his retirement in July 1984, as President and Chief Executive Officer of Ranchers Exploration Company, a US producer of uranium, silver, copper, and industrial minerals. He has again become active in the uranium production business through his privately-owned Albuquerque Uranium Corporation (AUC), and he has assumed management control of the uranium activities of Intercontinental Energy Corporation. Nuexco, through its Equity Transaction Services Group, advised AUC in the structuring and financing of this undertaking. Nuexco is pleased to have had the benefit of Lee's counsel, and we wish him all the best in his new activity.

* * *

In this issue, we have included several updated historical series of statistics for Australia, Canada and the USA, including historical US Government Prime Interest Rates and Discount Rates.

* * *

The US Supreme Court has granted DOE's petition for *writ of certiorari* in the US Producers vs. DOE lawsuit. This means that the Supreme Court will hear the case. In doing so, the Supreme Court will review the Appeals Court's earlier decision, which found that DOE did not have the discretion *not* to impose restrictions on the enrichment of non-US-origin uranium where a finding of nonviability for the US uranium industry was made. Until such time as the Supreme Court makes a determination in the case, the stay of implementation of the District Court order, granted by the Appeals Court, remains in effect. As of press time, no date had been set by the Supreme Court to hear the case, although a *projected* schedule has oral arguments beginning in April 1988.

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December 31, 1987	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$16.55**/lb. U_3O_8	4,750	2,395
US Premium	**$0.65**		
UF_6 VALUE	**$47.00**/kgU		
US Premium	**$2.00**		
CONVERSION VALUE	**$1.90**/lb. U as UF_6	700	320
SWU VALUE **0.3 tails assay:**	**$73**/SWU	490	255
LOAN RATE	**3.5%**/annum	4,950	0

TRANSACTION VALUE

$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
17.20	3.9	23	3

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed awillingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materialss delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of December 31, 1987)

The **Exchange Value** is **$16.55** per pound U_3O_8, down $0.10 since last month. US-origin uranium is commanding a **premium** (relative to the Exchange Value) of **$0.65** per pound U_3O_8 (down $0.20) in the form of concentrates, and **$2.00** per kilogram U (down $0.25) in the form of UF_6. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **4,750,000** pounds U_3O_8 equivalent, down 2,095,000 pounds since last month. The corresponding figure for **active demand** is **2,395,000** pounds, up 1,120,000 pounds. The spot and near-term supply-demand ratio decreased to 2.0 to 1.

The *Current Market Data* section of this Report lists nine U_3O_8 sales, totaling approximately 4.3 million pounds U_3O_8 equivalent.

The **Transaction Value** is **$17.20** per pound U_3O_8, down $0.60 since last month. The calculation extends over a 3-month period and includes 23 transactions involving 3.9 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$47.00** per kilogram U in UF_6, unchanged since last month. Five transactions involving UF_6 are reported, totaling approximately 2.7 million pounds equivalent U_3O_8.

The **Conversion Value** is **$1.90** per pound U as UF_6, unchanged since last month. Active supply of secondary market conversion services totals 700 thousand pounds U as UF_6. Active demand totals 320 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is **3.5 percent** per annum, unchanged since last month. No loan transactions are reported.

* * *

The **Exchange Value** declined $0.10, to $16.55 per pound U_3O_8 this month, reflecting increased competition among sellers for available opportunities. The **Premium** (relative to the Exchange Value) for US-origin U_3O_8 declined $0.20, to $0.65 per pound U_3O_8. Sellers of US-origin material became increasingly aggressive toward the end of the year, offering their uranium at prices near the $17.20 level (the Exchange Value plus the US Premium), even though the US Supreme Court has not yet decided to grant or deny DOE's petition for *writ of certiorari* in the US Producers vs. DOE lawsuit.

Active demand for U_3O_8 increased somewhat during December, although most of that demand is discretionary. At the end of the month, three US utilities were evaluating proposals for moderate quantities of material.

Six spot U_3O_8 transactions are reported this month, involving approximately 1,300,000 pounds. Of those transactions, about 350,000 pounds involved US-origin uranium. In addition, three long-term U_3O_8 transactions are reported, involving approximately 3,000,000 pounds bought by a US utility within the past few months, some of which was of US-origin. Altogether, transactions involving over 2 million pounds of US-origin U_3O_8 are reported this month.

Ever since the beginning of the US Producer vs. DOE lawsuit, anticipation of a favorable outcome has kept many US producers out of the near-term market. Near the end of the year, however, financial requirements typically have overridden the hope for prices near the $20 per pound level, and some producers have pursued spot sales. This year was no exception, and at least four US utility purchases of US-origin U_3O_8 in November and December involved US producers selling at reduced prices in the spot market.

The US-Canada Free Trade Agreement, which was signed by President Reagan and Prime Minister Mulroney on January 2, 1988, also has added downward pressure to the US Premium. The FTA has the potential to moot the effect of a producer victory in the Producers vs. DOE lawsuit by effectively disallowing any market restrictions for Canadian-origin uranium.

Several members of Congress have expressed concern over the Reagan Administration's lack of consultation with Congress on controversial provisions of the FTA, including the uranium issue. Representative Dan Rosenkowski (D-Illinois), Chairman of the House Ways and Means Committee and Senator Lloyd Bentsen (D-Texas), Chairman of the Senate Finance Committee stated the following in a December 3 letter to Tresury Secretary James Baker and US Trade Representative Clayton Yeutter: "With respect to the Canada FTA, however, the issue now is what type of procedure we will follow after the agreement is signed. In this regard, we must point out that the Congressional schedule next year makes it unlikely that we will be able to complete action on a draft implementing bill before June 1, 1988. We therefore propose that the Administration not submit a bill to implement the FTA

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under expedited procedures earlier than June 1, 1988." If such a schedule for implementation of the FTA actually occurs, Congressional approval could wait until perhaps September or even later.

The **UF_6 Value** remained unchanged during December, and the Premium (relative to the UF_6 Value) for US-origin UF_6 declined $0.25, to $2.00. Activity in the market for UF_6 increased in December, even though the active supply of UF_6 remains relatively weak, particularly of US-origin UF_6. Two spot UF_6 transactions are reported, totaling approximately 100,000 pounds U_3O_8 equivalent; one of those transactions involved US-origin material. In addition, three long-term UF_6 transactions are reported, involving approximately 2,500,000 pounds U_3O_8 equivalent. One of those long-term transactions also involved US-origin UF_6. As of the end of the month, two US utilities and at least one non-US utility were evaluating UF_6 offers.

* * *

The **Loan Rate** remained unchanged this month, at 3.5 percent per annum. Although little or no firm demand exists for loans, the supply of material available for loan remains substantial. No loan transactions are reported this month.

* * *

The **Conversion Value** remains unchanged this month at $1.90 per pound U as UF_6, and no conversion transactions are reported. Demand for secondary market conversion services has increased somewhat, as one US utility entered the market seeking a substantial quantity of conversion. Another potential seller of conversion services has entered the market, adding to the active supply. Sellers of excess conversion services tend to require relatively fixed sale prices, determined by the economics of selling versus deferring contractual obligations. Conversely, holders of UF_6 may find it necessary to discount the conversion component in order to sell the U_3O_8 component. Thus, conversion buyers who can find *deconversion swap* opportunities can realize measurable savings on their conversion.

ENRICHED URANIUM AND SWU

The **SWU Value** is $73 per SWU, unchanged since last month. One transaction took place in December involving a substantial quantity of non-DOE-origin SWU, bought by a European utility. Currently, there are a few inquiries by US utilities for non-DOE SWU. These inquiries, however, may not represent firm SWU demand, and may have been undertaken largely to support utilities' contingency plans should the US Supreme Court uphold the earlier Appeals Court decision in the US Producers vs. DOE lawsuit, a situation that could lead to a ban on DOE's enrichment of non-US-origin uranium. The presence of this market activity also could have the effect of inducing other utilities, those having unfilled SWU requirements, to enter the market sooner than they normally would.

There still exists a wide range of prices for various SWU origins. DOE, Eurodif, and Urenco SWU make up the high end of that range, while purchasers that can take SWU of Techsnabexport (USSR) origin may be able to obtain prices below the Nuexco SWU Value.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates This Month (Dec 31, 1987)	Last Month (Nov 30, 1987)	12 Months Ago (Dec 31, 1986)	per kg. U in Concentrates This Month (Dec 31, 1987)	Last Month (Nov 30, 1987)	12 Months Ago (Dec 31, 1986)
Australia (dollar)	22.97	24.02	25.21	59.72	62.43	65.55
Belgium (comm. franc)	552.22	580.34	678.06	1,436	1,509	1,763
Canada (dollar)	21.55	21.80	23.16	56.02	56.69	60.20
EEC (ecu)	12.81	13.47	15.73	33.31	35.02	40.90
Finland (markka)	65.70	68.01	80.65	170.81	176.82	209.68
France (franc)	89.36	94.33	108.00	232.32	245.25	280.77
FRG (mark)	26.40	27.82	32.58	68.62	72.34	84.70
Italy (lira)	19,480	20,462	22,681	50,643	53,197	58,966
Japan (yen)	2,041	2,245	2,677	5,305	5,837	6,961
Netherlands (guilder)	29.71	31.30	36.85	77.23	81.38	95.81
South Africa (rand)	31.92	32.84	36.81	82.98	85.38	95.71
Spain (peseta)	1,801	1,866	2,219	4,683	4,852	5,768
Sweden (krona)	96.50	100.30	114.10	250.88	260.76	296.64
Switzerland (franc)	21.35	22.84	27.22	55.50	59.39	70.76
UK (pound)	8.91	9.28	11.40	23.16	24.13	29.64
US (dollar)	16.55	16.65	16.75	43.03	43.29	43.55

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates This Month (Dec 31, 1987)	Last Month (Nov 30, 1987)	12 Months Ago (Dec 31, 1986)	per kg. U in Concentrates This Month (Dec 31, 1987)	Last Month (Nov 30, 1987)	12 Months Ago (Dec 31, 1986)
Australia (dollar)	23.87	25.62	26.12	62.06	66.75	67.90
Belgium (comm. franc)	573.91	620.43	702.34	1,492	1,613	1,826
Canada (dollar)	22.40	23.31	23.99	58.22	60.60	62.36
EEC (ecu)	13.32	14.40	16.30	34.62	37.44	42.37
Finland (markka)	68.28	72.71	83.54	177.52	189.04	217.19
France (franc)	92.87	100.85	111.86	241.45	262.19	290.82
FRG (mark)	27.43	29.75	33.75	71.32	77.33	87.73
Italy (lira)	20,245	21,875	23,494	52,632	56,871	61,078
Japan (yen)	2,121	2,400	2,773	5,514	6,240	7,210
Netherlands (guilder)	30.87	33.46	38.17	80.27	87.00	99.24
South Africa (rand)	33.17	35.11	38.13	86.24	91.27	99.13
Spain (peseta)	1,872	1,995	2,298	4,867	5,187	5,974
Sweden (krona)	100.29	107.23	118.19	260.74	278.77	307.26
Switzerland (franc)	22.19	24.42	28.19	57.68	63.49	73.30
UK (pound)	9.26	9.92	11.81	24.07	25.80	30.71
US (dollar)	17.20	17.80	17.35	44.72	46.28	45.11

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF₆ This Month (Dec 31, 1987)	Last Month (Nov 30, 1987)	12 Months Ago (Dec 31, 1986)	per kg. U as UF₆ This Month (Dec 31, 1987)	Last Month (Nov 30, 1987)	12 Months Ago (Dec 31, 1986)
Australia (dollar)	2.64	2.74	2.71	5.81	6.04	5.97
Belgium (comm. franc)	63.40	66.23	72.87	139.77	146.00	160.64
Canada (dollar)	2.47	2.49	2.49	5.45	5.49	5.49
EEC (ecu)	1.47	1.54	1.69	3.24	3.51	3.73
Finland (markka)	7.54	7.76	8.67	16.63	17.11	19.11
France (franc)	10.26	10.76	11.61	22.62	23.73	25.59
FRG (mark)	3.03	3.18	3.50	6.68	7.00	7.72
Italy (lira)	2,236	2,335	2,437	4,930	5,148	5,373
Japan (yen)	234.28	256.20	287.72	516.50	564.83	634.32
Netherlands (guilder)	3.41	3.57	3.96	7.52	7.88	8.73
South Africa (rand)	3.66	3.75	3.96	8.08	8.26	8.72
Spain (peseta)	206.81	212.98	238.41	455.95	469.54	525.60
Sweden (krona)	11.08	11.45	12.26	24.42	25.23	27.03
Switzerland (franc)	2.45	2.61	2.93	5.40	5.75	6.45
UK (pound)	1.02	1.06	1.23	2.25	2.34	2.70
US (dollar)	1.90	1.90	1.80	4.19	4.19	3.97

SWU VALUE AND UF₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value at 0.30% tails assay (Dec 31, 1987)	UF₆ Value per kg.U in UF₆ This Month (Dec 31, 1987)	UF₆ Value per kg.U in UF₆ Last Month (Nov 30, 1987)
Australia (dollar)	101.32	65.23	67.79
Belgium (comm. franc)	2,436	1,568	1,638
Canada (dollar)	95.05	61.19	61.55
EEC (ecu)	56.51	36.38	38.02
Finland (markka)	289.80	186.58	191.99
France (franc)	394.17	253.77	266.28
FRG (mark)	116.43	74.96	78.54
Italy (lira)	85,923	[illegible]	57,761
Japan (yen)	9,001	[illegible]	6,338
Netherlands (guilder)	131.04	[illegible]	88.36
South Africa (rand)	140.79	[illegible]	92.70
Spain (peseta)	7,946	[illegible]	5,268
Sweden (krona)	425.66	[illegible]	283.13
Switzerland (franc)	94.17	60.62	64.48
UK (pound)	39.30	25.30	26.20
US (dollar)	73.00	47.00	47.00

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4216	1987	less than 50	98—102	Producer	Intermediary	US-Origin
4217	1989-95	601-1,000	R[3]	Producer	Utility	US-Origin
4218	1989-95	601-1,000	R[3]	Producer	Utility	US-Origin
4219	1989-93	1,001-1,500	R[3]	Producer	Utility	
4220	1987	less than 50	98—102	Producer	Intermediary	US-Origin
4221	1988-90	1,001-1,500	See Remarks	R[3]	Intermediary	UF_6. Base-price escalated
4228	1988	50-100	98—102	Intermediary	Utility	US-Origin UF_6
4229	1987	101-300	98—102	Intermediary	Utility	US-Origin
4230	1988-92	601-1,000	See Remarks	Intermediary	Utility	UF_6. Base-price escalated
4231	1988	50-100	98—102	Producer	Utility	US-Origin
4234	1988-90	301-600	See Remarks	Intermediary	Utility	US-Origin UF_6 Base-price escalated
4235	1988	301-600	98—102	Intermediary	Utility	
4236	1988	301-600	98—102	Intermediary	Utility	
4237	1988	less than 50	93—97	Intermediary	Utility	UF_6

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4238	1988	101-300	R[3]	Intermediary	Utility		

---

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF6 Value) *plus* the premium (relative to the Exchange Value or UF6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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URANIUM SUPPLY
(December 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	 Intermediate or Long-term	Remarks
Available for Sale: ACTIVE			
87-1005*	200	400 per year	1988-95
87-1023	500	500 per year	1987-90
87-1053	100	400 per year	1989 on
87-1055	200	300 per year	1988-93
87-1061	200	200 per year	UF_6, 1988 on
87-1123	400	—	
87-1130	750	—	
87-1141	200	200 per year	1989-92
87-1152	200	—	
87-1156*	825	—	
87-1161*	1,000	1,000 per year	
87-1175*	175	—	UF_6
87-1001	—	400 per year	1989 on
TOTAL:	4,750		
INACTIVE			
87-1002*	270	—	
87-1017	1,000	—	
87-1059	120	—	UF_6
87-1120	1,000	—	
87-1135	500	—	
87-1142*	150	—	
87-1159*	40	—	
87-1019	—	600 per year	1988-91
TOTAL:	3,080		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1091, 1124.

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URANIUM DEMAND
(December 31, 1987)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near -term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
87-1030	175	—	1988
87-1121	650	650 per year	1988-96
87-1122*	500	—	1988
87-1138*	130	—	UF_6
87-1158*	150	—	U_3O_8 or UF_6
87-1163*	160	—	1989-92
87-1169*	260	—	U_3O_8 or UF_6
87-1174*	260	—	1988
87-1176*	110	—	1988
87-1013	—	1,200 per year	1990-95
87-1021*	—	200 per year	1992 on
87-1108	—	200 per year	1991-2000
87-1134	—	260	1989
37-1150	—	1,000 per year	1989-92
87-1166*		650	1989, UF_6
87-1172*	—	500 per year	1990 on
TOTAL:	2,395		
INACTIVE			
87-1040	300	300	1989
87-1049	—	700 per year	1989-96
87-1114	525	—	
87-1125	390	—	
87-1146	3	—	
TOTAL:	1,218		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1107, 1124, 1140 .

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(December 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1119	500	—	
87-1157	4,000	—	
87-1167*	450	—	
TOTAL:	4,950		
INACTIVE			
87-1012	2,000	—	
87-1031	1,000	—	
87-1033	1,000	—	
87-1071	1,000	—	UF_6
TOTAL:	5,000		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 106[illegible].

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CONVERSION SUPPLY AND DEMAND
(December 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6)		Remarks
	Within 3 Years	Beyond 3 Years	
Available for Sale:			
ACTIVE			
87-1155	550	—	
88-1004*	150	—	
TOTAL:	700	750	
INACTIVE			
87-1008	750	750	
TOTAL:	750		
Inquiries to Purchase:			
ACTIVE			
87-1132	220	—	
87-1160*	100	—	
TOTAL:	320		
INACTIVE			
87-1072	440	—	
TOTAL:	440		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 1009, 1122.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(December 31, 1987)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1058	90	—	1988
87-1068	100	—	1988
87-1096	300	—	1988
TOTAL:	490		
INACTIVE			
87-1004	55	—	1988
87-1128	300	—	1988
87-1130	150	—	1989
TOTAL:	530		
Inquiries to Purchase:			
ACTIVE			
87-1162*	100	—	1988
87-1171*	130	—	1988
87-1154*	25	—	1988
TOTAL:	255		
INACTIVE			
87-1065	150	—	1988
87-1116*	100	—	1989
TOTAL:	250		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 1059.

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1987 US URANIUM PRODUCTION ACTIVITIES

Introduction

In 1987, political and legal uncertainties continued to dominate the US uranium industry. These uncertainties — the US Producer vs. DOE lawsuit, potential legislation and the pending Free Trade Agreement with Canada — acted to limit development and to constrain expenditures on all but the most economically attractive projects.

Overall, the US uranium production industry was fairly stable, although at rather low production levels, during 1987. Data available at the end of the year indicate that production from all sources totaled approximately 12,500,000 pounds U_3O_8, a decrease of 10 percent from 1986 production of 13,900,000 pounds. Changes at three production facilities largely accounted for the drop in output:

1. Cotter Corporation's Schwartzwalder mine in Colorado suspended operations in January;
2. USX Corporation's (formerly U.S. Steel) south Texas solution mining operations changed over from production to restoration in early 1987; and,
3. Production at the Umetco Minerals/Energy Fuels Nuclear White Mesa mill declined by 400,000 pounds to 4,500,000 pounds U_3O_8.

The distribution of production between conventional, by-product and solution mining remained similar to 1986 (Table 1).

Table 1

DISTRIBUTION OF US PRODUCTION BY TYPE*
(Millions of Pounds U_3O_8)

	1982	1983	1984	1985	1986	1987
By-Product	3.2	3.1	3.1	3.6	3.6	3.7
Conventional	20.6	14.8	9.5	5.4	8.8	7.8
Solution Mining	3.0	2.8	2.1	2.1	1.5	1.0
Total	26.8	20.7	14.7	11.1	13.9	12.5

*Nuexco estimates.

Conventional Producers

The Colorado Plateau and the Arizona Strip — Nuexco estimates that the White Mesa uranium mill at Blanding, Utah produced about 4,500,000 pounds U_3O_8 in 1987; 3,800,000 to the account of **Energy Fuels Nuclear** and its Swiss partners, and 700,000 to the account of **Umetco Minerals Corp.** The mill's 1986 production was 4,900,000 pounds. (Table 2 shows the status of conventional uranium mills in the USA.)

The White Mesa mill was built by Energy Fuels and its partners in 1980, to process medium-grade (0.10 to 0.20 percent U_3O_8) ores from a variety of independent and company-owned mines in the Hanksville/Blanding region. The lower uranium prices in the early 1980s forced most of those mines to close. During the same period, however, Energy Fuels' aggressive exploration program in northern Arizona made discoveries of high-grade (over 0.30 percent U_3O_8) ores in breccia pipes. Thus, while the mill was designed to produce about 1,600,000 pounds U_3O_8 per year, the availability of these higher-grade ores have permitted an output of almost 5,000,000 pounds per year during the last two years.

Energy Fuels has mined breccia-pipe ores from the Hack Canyon and Pigeon mines on the north side of the Grand Canyon. The Hack Canyon pipes (3 in all) have been mined out and the mine area currently is being reclaimed. A new mine, Kanab North, is ready to begin production for Energy Fuels in 1988. The Pine Nut and Hermit mines are being developed and are expected to start producing in 1990. Development of the Canyon pipe, the first new mine on the south side of the Grand Canyon, has been repeatedly delayed by environmentalist opposition. The mine's location on the south side of the Canyon between Grand Canyon Village and Flagstaff also gives it a higher visibility than most other mines in the region.

Umetco Minerals, a subsidiary of Union Carbide Corporation, has a 70-percent interest in the White Mesa mill but does not have sufficient high-grade reserves to fully utilize its share of the mill's production capability under current market conditions. During 1987, Umetco produced approximately 700,000 pounds of U_3O_8 from ores mined in the Egnar Plains area on the Colorado/Utah border.

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Table 2

1987 OPERATING STATUS OF CONVENTIONAL URANIUM MILLS IN THE USA

Company	Approximate Operating Schedule or Status	Rated Capacity[1]	Location
Active Mills			
Chevron Resources Co.	Partial	2,500	Hobson, Texas
Cotter Corp.	Suspended	1,200	Canon City, Colorado
Homestake Mining Co.	Partial	3,400	Grants, New Mexico
Pathfinder Mines	Partial	2,800	Gas Hills, Wyoming
Pathfinder Mines	Partial	1,800	Shirley Basin, Wyoming
Rio Algom Corp.	Full	750	La Sal, Utah
Umetco/ Energy Fuels Nuclear	Periodic	2,000	Blanding, Utah
Umetco (Union Carbide)	Heap Leaching	1,400	Gas Hills, Wyoming
Inactive Mills[2]			
American Nuclear Corp.	Inactive	950	Gas Hills, Wyoming
Anaconda (ARCO)	Inactive[3]	6,000	Grants, New Mexico
Atlas Minerals	Inactive	1,400	Moab, Utah
Bear Creek Uranium	Dismantled	2,000	Powder River Basin, Wyoming
Bokum Resources Corp.	Incomplete	2,000	Marquez, New Mexico
Conoco/Pioneer	Dismantled	3,400	Falls City, Texas
Dawn Mining Company	Inactive	450	Ford, Washington
Exxon Minerals Company	Dismantled	3,200	Powder River Basin, Wyoming
Quivira Corp. (Kerr-McGee)	Inactive	7,000	Grants, New Mexico
Minerals Exploration Company	Inactive	3,000	Red Desert, Wyoming
Petrotomics Company	Dismantled	1,500	Shirley Basin, Wyoming
Plateau Resources Ltd.	Inactive	1,000	Ticaboo, Utah
Sohio Western Mining	Dismantled	1,600	Cebolleta, New Mexico
Umetco (Union Carbide)	Inactive	1,300	Uravan, Colorado
UNC Resources	Inactive[4]	3,000	Church Rock, New Mexico
Western Nuclear Inc.	Inactive	1,700	Jeffrey City, Wyoming
Western Nuclear Inc.	Inactive	2,000	Wellpinit, Washington

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[1] Capacity in tons of ore per day (tpd).
[2] Mill inactive throughout 1987.
[3] Decommissioning expected to begin in 1988.
[4] Decommissioning plan currently under review by the NRC.

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Since the White Mesa mill has a greater capacity than its tributary mines, it will be closed through mid-1988, while the miners build up sufficient stockpiles for an operating run of 8 to 12 months. A modest improvement in the uranium market, coupled with a favorable outcome in the miners' legal contest with those opposing development at the Grand Canyon's southern rim, as well as continued production by Umetco, could result in long-term, full utilization of the mill's capacity. Such utilization would enable the White Mesa mill to continue as the foremost US production facility.

Only **Homestake Mining Co.** continued to produce some U_3O_8 by conventional methods in the Grants, New Mexico area. At the company's Section 23 mine, a small crew is mining small quantities of higher-grade material.

Rio Algom Corp. continued to operate its Lisbon, Utah mill, using both company and outside-source ore to produce about 700,000 pounds U_3O_8 in 1987. Presently, however, the company is operating the mill on a day-to-day basis, as Lisbon's reserves are nearly depleted and uranium prices remain low. Production from its deep (2,600 feet, 800 meters), underground mine began in 1972, making it one of the longest-producing US uranium mines.

One more veteran uranium producer may have dropped out of the business in 1987; **Atlas Corporation** announced plans to liquidate its uranium assets in order to concentrate efforts on precious metals. The Atlas mill in Moab, Utah was licensed in 1956 and was producing 1,800,000 pounds per year as recently as 1982. Atlas' decision to withdraw from uranium follows problems with the NRC in re-licensing the mill. Even after announcing its withdrawal, however, Atlas has continued to press for renewal of its NRC license and that renewal currently is under review by the NRC.

The South Texas Region — A joint venture of **Chevron Resources Co.** (60 percent) and **Total Minerals Corp.** (40 percent) has started development at Rhode Ranch. Ore from this shallow deposit will be processed at Chevron's Panna Maria mill, which currently is treating ore from its Mt. Taylor mine. Production from Rhode Ranch is expected to begin in January 1988, at a rate of over 1,000,000 pounds U_3O_8 per year. This development is particularly notable as the first new US open-pit mine since the late 1970s.

Anaconda Minerals Company, a subsidiary of the Atlantic Richfield Corp., had previous title (25 percent) to the Rhode Ranch deposit along with Concorde Oil Company (25 percent), Ensearch Corporation (25 percent), Rutherford Oil Corporation (12.5 percent) and the Rowe Estate (12.5 percent). The joint venture received a license from the NRC to build a uranium mill at the Rhode Ranch site in October 1982, but the project was not developed at that time.

The Rhode Ranch project is 80 miles south of Chevron's Panna Maria mill, which was built to process ore from Chevron's Panna Maria open-pit mine. This mine was placed on standby in June 1985. Uranium deposits at Rhode Ranch average less than 100 feet in depth and are higher grade (over 0.20 percent U_3O_8) than most deposits in the south Texas region. Chevron probably will use most of the Panna Maria mine equipment for mining at Rhode Ranch, and ship the ore produced to Panna Maria by truck.

Chevron acquired the Mt. Taylor project when it bought Gulf Oil Co. in 1984. Gulf developed the mine during the late 1970s but was unable to sustain production. Under Gulf, the mine produced about 1,800,000 pounds U_3O_8 from a resource exceeding 100,000,000 pounds. The mine was placed on standby in 1982. Chevron wrote off Gulf's capital investment ($430 million) and revised their mine plan to concentrate on higher-grade ores and reduced tonnage.

Currently, Mt. Taylor produces about 600 tons of ore per day at an average grade of about 0.5 percent U_3O_8, totaling about 1,500,000 pounds U_3O_8 per year. Ore from Mt. Taylor is transported to the Panna Maria mill, a distance of over 900 miles, by rail. Chevron continues to evaluate various options which might utilize some of the shutdown mill capacity in the Grants, New Mexico area. This capacity includes Anaconda's Bluewater mill, the Quivira Mining Co. mill, the Homestake mill and Bokum Resources Corporation's nearly completed Marquez mill. Homestake currently is milling small quantities of lower-grade stockpiled material from the Mt. Taylor mine on a test basis. Should market conditions allow, the Mt. Taylor mine has the reserves and production capability to at least double its current output. In that instance, local milling might assume an even greater importance.

Colorado — The **Cotter Corporation's** Schwartzwalder mine near Golden, Colorado suspended operation in

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January 1987. This mine has produced approximately 15,000,000 pounds U_3O_8 during its 35-year operating life. The mine uses a radiometric sorter to reduce waste in the relatively high grade (about 0.30 percent U_3O_8) ore prior to shipping it to Cotter's mill at Cañon City, Colorado. This mill was built in 1979 as an acid leach plant, replacing the original alkaline circuit mill built there in 1958. Cotter also had some minor production from its Thornberg mine, using a contractor who shipped the ore to Rio Algom's Lisbon mill.

Wyoming — The only open-pit uranium mines that operated in the USA during 1987 were **Pathfinder Mines Corporation's** Shirley Basin and Gas Hills, Wyoming properties. These operations produced somewhat more than 500,000 pounds U_3O_8 in 1987. The Gas Hills mill, which was built in 1958, recently has been refurbished and is operating below capacity processing low-grade stockpiles. The mill was closed for over two years before reactivation in July 1987. Mining operations also were suspended during that period and are not expected to resume prior to the spring of 1988.

Pathfinder conducted both underground and solution mining in the Shirley Basin from 1960 through 1970, when the open pit was developed. Current plans at Shirley Basin include a short shutdown of the mill in the near future so that waste stripping can uncover more ore, followed by a gradual increase back to an annual production level of about 12,000,000 tons of waste, 220,000 tons of ore and 750,000 pounds of U_3O_8.

Solution Mining

In 1987, US uranium production from solution mining declined to less than one million pounds U_3O_8 for the first time since 1975. Both **USX Corp.** and **Everest Minerals Corp.** moved from active production to restoration at previously high-output production centers. A number of recent developments, however, could result in a significant increase in future production from solution mining. Table 3 shows the status of solution mining projects in the USA.

Texas and New Mexico — The Clay West project began operation in 1975 as the largest uranium solution mining project built to that date, with an initial capacity of 250,000 pounds U_3O_8 per year. At that time, the ownership of the project was split between Atlantic Richfield (50 percent, operator), U.S. Steel (25 percent) and Dalco (25 percent). Since 1975, the project has been scaled up, producing a high of 1,200,000 pounds in 1981, and ownership has changed to include only U.S. Steel, now **USX Corp.**, (50 percent, operator) and **Niagara Mohawk Power Corp.** (50 percent). Recent production from the Clay West project has been in the range of 500,000 to 800,000 pounds per year; 1987 production is estimated to be approximately 100,000 pounds U_3O_8, as much of the changeover from production to restoration was made in early 1987. USX's wholly-owned and adjoining project, Burns Ranch, was shut down in July 1986.

Everest Minerals' Mt. Lucas project changed over to restoration in late 1987, after averaging about 500,000 pounds per year since 1984. In December 1987, Everest started up the Tex-1 project which, in combination with the nearby satellite Gruy project (expected to start up in 1988), is scheduled to produce 500,000 pounds U_3O_8 per year through Everest's Hobson recovery facility.

Malapai Resources Co. bought the Holiday/El Mesquite and O'Hern properties in south Texas from Mobil Oil in late 1987. Under Mobil's management, these properties produced about 500,000 pounds in 1981, but smaller quantities more recently.

Uranium Resources, Inc. (URI) is preparing its Kingsville Dome and Rosita projects to begin production in 1988. Kingsville Dome is scheduled to start operating in April 1988, at a production rate of 800,000 pounds U_3O_8 per year. Rosita is scheduled to begin production in July 1988, at a rate of 500,000 pounds U_3O_8 annually. URI also is preparing a solution mining permit application for its Churchrock, New Mexico project, formerly operated as a conventional underground mine by United Nuclear Corp.

Total Minerals Corp. acquired the West Cole project from Tenneco Minerals in 1987. This project is located in Webb County, Texas and was placed on standby by Tenneco in 1984. Total reactivated the facility in 1987 and expects to produce 200,000 pounds U_3O_8 per year by 1990.

Intercontinental Energy Corp. (IEC) increased production at its Lamprecht facility to almost 100,000 pounds in 1987.

In December 1987, Greenwood Holdings, Inc. (GHI) purchased IEC, distributing all of IEC's oil-related assets and liabilities to GHI, leaving IEC with only uranium-related interests. Following that move, a newly-formed IEC Employee Stock Ownership Trust and a group of US and European investors purchased all of IEC's outstanding capital stock; the investment group received 49 percent of the

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Table 3

CURRENT STATUS OF SOLUTION MINING PROJECTS IN THE USA

Location	Company	Mine Site	Current Status
Nebraska	Ferret Exploration Co.	Crow Butte	Permitting
		Big Red	Exploring
New Mexico	Mobil Oil Corp.	Crown Point	Undeveloped
	Uranium Resources, Inc.	Church Rock	Permitting
Texas	Caithness Mining Corp.	McBride	Restored
	Chevron	Palangana	In Restoration
	Conoco, Inc.	Trevino	Restored
	Everest Exploration, Inc.	Hobson-1	Restored
		Hobson Tex-1	Operating
		Las Palmas	In Restoration
		Mt. Lucas	In Restoration
		Gruy-7B	Permitting
	Intercontinental Energy Corp.	Pawnee	In Restoration
		Zamzow	In Restoration
		Lamprecht	Operating
	Malapai Resources Co.	El Mesquite	Operating
		Holiday	Operating
		O'Hern	Operating
	Total Energy Resources	West Cole	Operating
	USX, Inc.	Boots/Brown	In Restoration
		Burns/Moser	In Restoration
		Clay West	In Restoration
		Pawlik	In Restoration
	Uranium Resources, Inc.	Benavides	In Restoration
		Kingsville Dome	Under Development
		Longoria	Restored
		Rosita	Permitting
	Westinghouse Electric Corp.	Bruni	In Restoration
Wyoming	Malapai Resources Co.	Irigaray	Operating
		Christensen Ranch	Permitting
	Everest Minerals Corp.	Highland	Under Development
	Sequoyah Fuels Corp.	Bill Smith	Pilot Plant Operating
	Ogle Petroleum Corp.	Bison Basin	In Restoration[1]
	Uranerz USA	Ruth	Undeveloped
	CEB Co.	Leuenberger	Undeveloped

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[1] Being restored by Altair Resources after default by Ogle.

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stock and the right to appoint a majority of the Board of Directors. The Board consists of Mr. Leland O. Erdahl, Mr. Leo Rostermundt, and the CEO of GHI, who is Mr. Robert A. Fillingham. IEC's uranium operations will be managed by Mr. Erdahl.

Wyoming and Nebraska — **Everest Minerals** expects to begin production at its Highland, Wyoming project in January 1988, at the rate of 800,000 pounds U_3O_8 per year. **Malapai Resources** acquired the Irigary, Wyoming project from Westinghouse, and restarted the plant in late 1987. Malapai forecasts 1988 production from Irigary at 250,000 pounds U_3O_8. Malapai also has plans to start production at its Christensen Ranch, Wyoming property in 1989.

In the longer term, **Ferret Exploration Company's** Crow Butte, Nebraska project is expected to be capable of producing 1,000,000 pounds per year in the early 1990s. Ferret has submitted an application for full commercial production, and initial production at a rate of 500,000 pounds U_3O_8 per year is expected in 1989.

By-Product Production

By-product uranium production in the USA is dominated by **International Minerals and Chemical Corp.** (IMC) and **Freeport Uranium Recovery Company**, which produce about 1,900,000 and 1,200,000 pounds per year, respectively. Both producers extract uranium from phosphoric acid, derived from the processing of phosphate rock. Additional capacity for the production of U_3O_8 from phosphoric acid is available, but currently is on standby due to lack of demand for phosphoric acid. Uranium producing phosphoric acid production facilities are summarized in Table 4.

By-product uranium also has been produced in the USA from coal, copper, beryllium and rare earth recovery facilities. Currently, **Rhone Poulenc** recovers about 30,000 pounds U_3O_8 per year from the processing of rare earth oxides at its plant in Freeport, Texas, and **Energy Fuels** produces U_3O_8 as a by-product of copper at its plant at Bingham Canyon, Utah. The Energy Fuels' operation extracts about 10,000 pounds U_3O_8 per month. **Brush Wellman, Inc.**, which produced a few thousand pounds per year from its beryllium operation in Utah, decommissioned its uranium production circuit in 1987. The uranium from copper processing facility at Anamax's inactive Twin Buttes mine was sold to **Cyprus Minerals**, which operates the nearby Bagdad copper mine. Cyprus has not announced any plans to install or operate that facility.

Several mines in the Grants, New Mexico district produce by-product uranium by treating the mine water pumped from uranium mines. **Homestake Mining Co.** and **Quivira Mining Co.** currently recover a total of about 400,000 pounds U_3O_8 per year from mine waters in conventional underground mines, most of which are no longer in operation.

CORRECTION

Nuexco's December 1987 article entitled "Radiometric Ore Sorting" contained two errors. The article states: "Overall, sandstone ores, which comprise over 90 percent of the world's uranium resources, are not particularly suitable for sorting."

In fact, sandstone ores comprise less than 40 percent of WOCA "Reasonably Assured Resources" (RAR) at a cost of less than \$130/kgU according to *Uranium: Resources, Production and Demand* by the OECD Nuclear Energy Agency and the International Atomic Energy Agency (1986).

Only detailed testwork can provide the information necessary to make an informed judgment of the economics of sorting any ore. Friable, poorly-cemented sandstone ores, such as those found in the Wyoming Basins in the USA, are not particularly suitable for sorting. However, well-cemented sediments, which are more likely to occur in older formations, such as the Permian Karoo of South Africa, and the Permian and Triassic sediments of the western USA, are more likely to be suitable for sorting. For example, the Lodeve project in France uses a sorter to process a Permian sediment, although the sorter was not part of the original plant.

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Table 4

URANIUM BY-PRODUCT FROM PHOSPHORIC ACID PRODUCTION

(Millions of Pounds U_3O_8)

Production Facility	Phosphoric Acid Producer	Uranium Producer	Capacity lbs U_3O_8/yr	Current Status	Comments
New Wales, FL	IMC	IMC	1,200,000	Operating	Opened in 1980
Plant City, FL	CF Industries	IMC	700,000	Operating	Opened in 1980
Bartow, FL	CF Industries	IMC	500,000	Standby	Closed in July 1985
Uncle Sam, LA	Freeport	Freeport	800,000	Operating	Opened in 1978
Donaldsonville, LA	Agrico Chem. Co.	Freeport	450,000	Operating	Opened in 1981
Bartow, FL	Farmland Industries, Inc.	UG USA, Inc.	400,000	Standby	Purchased from Westinghouse in 1985. Last operated in Sept. 1981.
Tampa, FL	Gardinier, Inc.	Gardinier, Inc.	425,000	Mothballed	Closed in March 1982
Mulberry, FL	W. R. Grace & Co.	UNC Resources, Inc.	300,000	Renovation*	Closed in 1980.
Calgary, Alberta	Western Coop. Fertilizers, Ltd.	Earth Sciences Inc.	120,000	Standby	Closed in August 1987
TOTAL			4,895,000		

*Currently being renovated to treat industrial waste for the recovery of strategic metals, including uranium.

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UNITED STATES

EIA Releases Annual Viability Assessment

The US Energy Information Administration (EIA — an independent statistical and analytical agency within the US Department of Energy) has released its annual report entitled "Domestic Uranium Mining and Milling Industry: 1986 Viability Assessment." The purpose of the EIA study is to provide the Secretary of Energy with the information needed to make an annual determination of the industry's viability, as required under a 1983 amendment to the Atomic Energy Act of 1954. Although the Secretary of Energy has not yet issued his determination for 1986, the 1986 assessment indicated that the industry had not recovered significantly from the previous year (in which it was deemed non-viable) despite somewhat increased production.

The first annual determination of industry viability took place in 1984 for the calendar year 1983; Secretary of Energy Hodel found that the domestic uranium mining and milling industry was viable for that year. For the following year, 1984, Secretary Herrington determined that the industry was not viable, and announced that he would undertake three steps designed to aid the domestic industry:

1. The Secretary authorized DOE to offer a free variable tails assay option (VTAO) each year to customers willing to commit to buy 100 percent of their requirements from DOE over a rolling five-year period.
2. He postponed a DOE plan to enrich some feed taken from its own uranium stockpile. As this item also was sought in Count IV of the US uranium producers' lawsuit against DOE, the Department later announced that it would not implement the plan at all.
3. Herrington also asked the US Trade Representative to examine the foreign trade and policy issues concerning uranium imports so that DOE could determine the appropriate courses of action under US trade laws. Trade Representative Clayton Yeutter then recommended that no action be taken, basing his recommendation on the conclusions of an interagency task force that import restrictions would bring at best only short-term relief to the US industry, and would be likely to antagonize US trading partners.

Viability Assessment Criteria

The Secretary of Energy is required to monitor and annually to determine the viability of the US uranium industry. A 1983 rulemaking set forth several criteria to be considered in determining the industry's viability, and the EIA's viability study provides data and information that measure the industry's capability. The criteria define four major "attributes of viability:"

1. Resource Capability — Whether domestic economic uranium reserves can supply all domestic needs for a future ten-year period.
2. Supply Response Capability — The level of domestic uranium production capacity sufficient to meet projected domestic nuclear power needs for a ten-year period.
3. Financial Capability — The ability of the domestic uranium industry to obtain funds adequate to finance the level of production capability defined under supply response capability.
4. Import Commitment Dependency — Whether executed contracts or options for (natural or enriched uranium) will result in greater than 37.5 percent of actual or projected domestic uranium requirements being supplied by (uranium from) foreign sources for any period of two consecutive years.

The EIA assessment both provides information for the year under consideration and makes projections of future conditions of each of the four fundamental attributes as well as some related ones, such as a projection of industry status under both supply disruptions and free market conditions. Some of the more important and interesting data and conclusions are summarized below.

Current Status of the Industry

The latest viability report has concluded that almost all of the short-term indicators of the US uranium industry's health are weak, although several appear to have strengthened somewhat since 1985, when the Secretary found that the industry was not viable.

1. US uranium production in 1986 totaled 13.5 million pounds U_3O_8, up 19 percent from the 1985 level of 11.3 million pounds, which was the lowest since 1956. The number of sources contributing to production has dropped from 50 in 1984, to 41 in 1985, to 35 in 1986.
2. During the years 1983 to 1986, the domestic uranium industry lost a total of $766 million, including a 1985 total of $419 million. In 1986, the industry's net deficit improved, to $42 million. However, total industry assets, including both current and non-current assets as well as property, plant and equipment (PP&E) have declined steadily, dropping from approximately $3,558 million in 1982 to approximately $1,771 million in 1986 (Figures 1 and 2).
3. Exploration expenditures in 1986 increased slightly to $22.1 million, after having fallen from $27.4 million in 1984 to $20.6 million in 1985. Drilling activity, the primary indicator of exploration effort, increased from 1.8

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Figure 1
US Uranium Industry Income

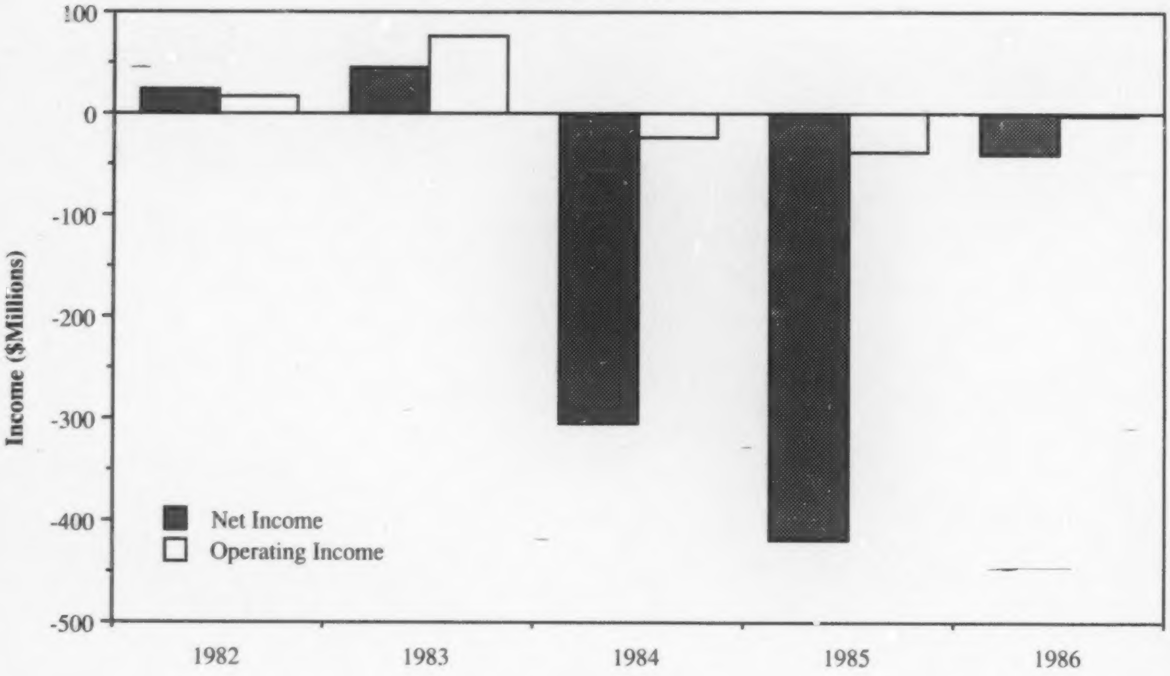
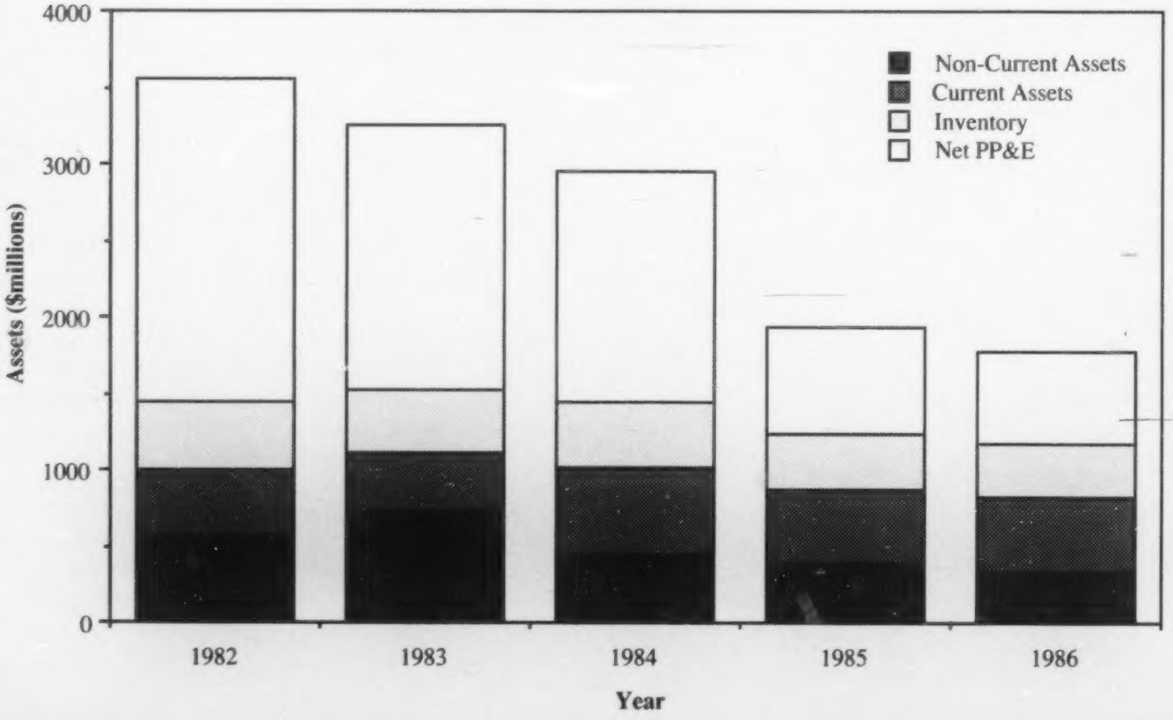


Figure 2
US Uranium Industry Assets



million feet in 1985 to 2.1 million feet in 1986.

4. Overall uranium industry employment in 1986 dropped to a low of 2,100 person-years, a 13-percent decline from 1985 and a 77-percent decline from 1982. Employment specifically in uranium mining was about 22-percent lower than in 1985, while employment in milling remained approximately the same as the previous year.

5. The production costs of most US uranium producers remain above recent contract prices.

Import Commitment Dependency

For 1986, the EIA study showed that the US utilities as a group used somewhat more imported uranium as a percentage of their requirements than in most previous years. Imports accounted for about 44 percent of domestic utility requirements in 1986. Imports represented 52 percent of US requirements in 1982, 26 percent in 1983, 39 percent in 1984, and 34 percent in 1985.

Import commitment dependency that results in imports totaling more than than 37.5 percent of US requirements for two consecutive years is one of the criteria used to assess viability. It should be noted, however, that this indicator tends to fluctuate widely from year to year depending on contract volume, making it difficult to discern any real trends from these figures. According to the study's projections for future years, "annual imports of natural and enriched uranium for the reference case are about 30 percent of requirements in 1987, increase to above 50 percent in 1991, and reach a peak of about 64 percent in 1998."

Disruption Scenarios and Supply Response Capability

In its assessment, the EIA study uses hypothetical supply disruption scenarios to estimate the US industry's ability to respond over the next ten years to a one-third disruption of uranium import contracts now in place. In other words, if one-third of the non-US uranium supply currently under contract became unavailable for delivery, would the US uranium industry be able to produce enough to compensate for the decrease in non-US uranium imports? The study examined the US industry's resource capability, financial capability, and ability to meet the supply security requirements of US utilities, and concluded the following:

1. As with the previous year's study, even with a one-third disruption of foreign supplies, "the amounts of domestic-origin uranium reported by suppliers as likely to be available over the next 10 years indicate that the uranium industry could fill domestic uranium supply security requirements. . ."

2. DOE estimates of reasonably assured resources in the USA support the above conclusion.

3. However, in the study's 1991 through 2000 scenario, the industry's projected domestic capacity falls slightly below the annual security requirements in the reference case; the study notes that the shortfall could be met through increased inventory drawdowns.

4. For the short-term disruption scenarios, mining and milling capacity that already exists, either in operation or standby, can meet or come close to meeting uranium requirements through reactivation and increased utilization. However, increasing production during a disruption period would likely require higher prices.

Conclusion

The 1986 EIA Viability Assessment portrays the US uranium industry as similar in overall condition to the previous year, when it was found to be non-viable. 1986 production increased over 1985, and the level of net operating losses was not as great as in 1985. However, employment and industry assets continued to drop, and the number of firms and their capital investments were at their lowest level since 1973. The level of imports as a percentage of US utility requirements was 34 and 44 percent in 1985 and 1986, respectively, and EIA projections of import levels in the 1990s show a steady rise in imports, to a peak of 64 percent in 1996.

* * *

Herrington Declares US Uranium Industry Non-Viable in 1986

Following the publication of the EIA study, Secretary Herrington declared the US uranium industry non-viable for calendar year 1986. This finding makes the third consecutive year that the industry has been deemed non-viable.

In his rationale for the decision, Secretary Herrington reiterated the findings of the EIA study, noting in particular that the "technical capability of the industry is dependent upon the ability of the industry to generate funds. Thus, the supply response capability must be reviewed in conjunction with the financial capability of the industry." He went on to state that "to maintain an adequate supply response capability in the future, capital expenditures higher than those projected without an import disruption would be necessary. The potential to raise the required investment funds would be dependent upon higher revenues and expectations of profitability. Neither higher revenues nor improved profitability are expected for the uranium industry in the next several years."

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CANADA

Changes to Uranium Project Ownership Policy Announced

On December 23, 1987, the Canadian Government announced changes in its policy toward foreign ownership of uranium projects. The old policy generally limited non-Canadian ownership of uranium projects to 33 percent; the change allows foreign participation to reach a level of 49 percent of an individual uranium property when it comes into production. A press release from the office of the Hon. Gerald S. Merrithew, Minister of State (Forestry and Mines) further stated that "In cases in which a project is controlled by Canadians, a reduction from the 51 per cent minimum Canadian participation level may be permitted, allowing Canadians more flexibility in raising capital for projects as long as they maintain controlling interest."

In the first act under the new policy, Minister Merrithew approved a transaction by which Korea Electric Power Corporation (KEPCO) bought a two-percent non-voting participating equity interest from the Saskatchewan Mining Development Corp. (SMDC) in the Cigar Lake joint venture in Saskatchewan. Part of the sale includes a long-term uranium supply contract to KEPCO. The contract is for delivery of U_3O_8 over the period 1993 to 2002, with provisions for a ten-year extension. The Minister's office estimates the total value of the contract at about $150 million at current Canadian export prices. The Cigar Lake joint venture is being developed by a consortium consisting of SMDC, Cogema Canada Ltd., Corona Grande Exploration Corp. (wholly-owned by Cogema) and Idemitsu Uranium Exploration Canada Ltd. (Table 5), and is expected to begin production in the mid-1990s.

The new policy is part of an increasing emphasis on Canada's part to encourage investment in its uranium mining industry. The bulk of any increased investment in uranium production is likely to take place in Saskatchewan, and boosting that province's economic development clearly is one of the reasons behind the shift in policy.

Before the KEPCO deal, the Cigar Lake project was owned 50.75 percent by SMDC, 36.375 percent by Cogema Canada Ltd., and 12.875 percent by Idemitsu Canada. This ownership structure had been approved under the earlier policy, even though the Canadian interest was less than the two-thirds normally required, because SMDC retained a controlling interest. KEPCO's non-voting equity reduces SMDC's share to 48.75 percent, but allows the Canadian firm to retain control.

Table 5

NEW OWNERSHIP OF CIGAR LAKE JOINT VENTURE

Company	Percent Ownership
SMDC[1]	48.75
Cogema Canada Ltd.	32.625
Corona Grande Exploration Corp.[2]	3.75
Idemitsu Uranium Exploration Canada Ltd.	12.875
KEPCO[3]	2.00

[1] SMDC = Saskatchewan Mining Development Corporation.
[2] A wholly-owned subsidiary of Cogema Canada Ltd.
[3] KEPCO = Korea Electric Power Company. This is a non-voting interest.

Clearly, the change in government policy will most affect projects under development, or to be developed, and primarily in Saskatchewan, at least for the foreseeable future. It is possible that other uranium consumers may consider (or reconsider) the benefits of equity participation, particularly in identified low-risk projects. For project owners, the change in policy presents an opportunity to attract additional capital and secure long-term customers, resulting in an improved production and marketing situation.

Since 1981, non-Canadian companies have maintained a relative share of exploration expenditures in Canada of about 55 percent. However, the US companies' portion has dropped from about 28 percent in 1981 to less than two percent today, and participation by non-US companies has risen proportionately. Most of the US companies were affiliated with major oil companies, while most of the other non-Canadian firms participating in exploration are affiliated with or sponsored by utilities or governments. With the opportunity to obtain more equity in Canadian uranium developments, there could be even greater incentive now to increase exploration efforts.

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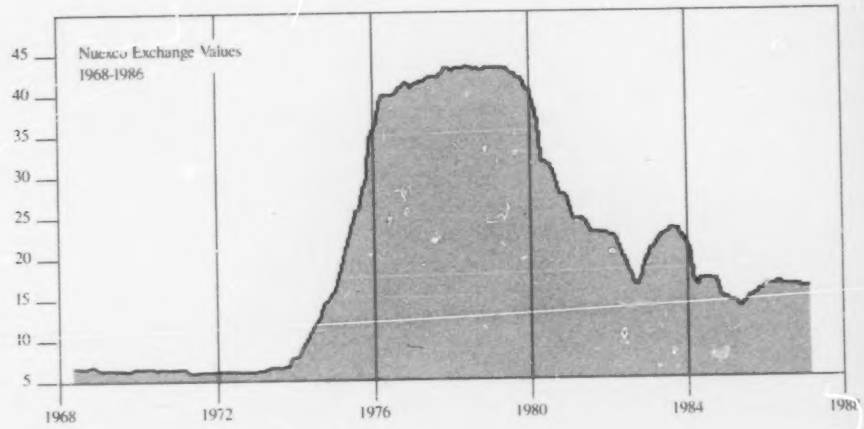
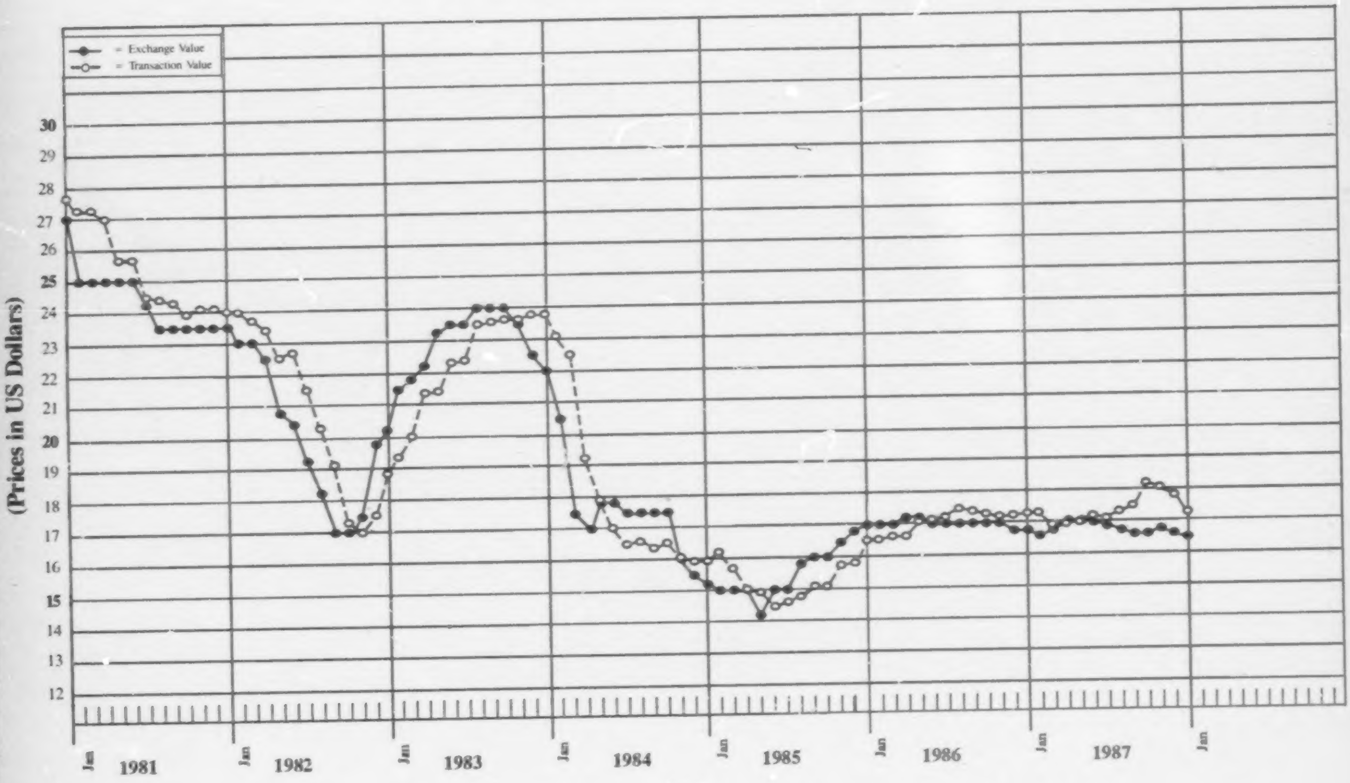
HISTORICAL MARKET DATA





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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969		6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	**16.55**

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	**17.20**

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HISTORICAL MARKET DATA

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	**1.90**

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated (US Dollars/kg. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	**47.00**

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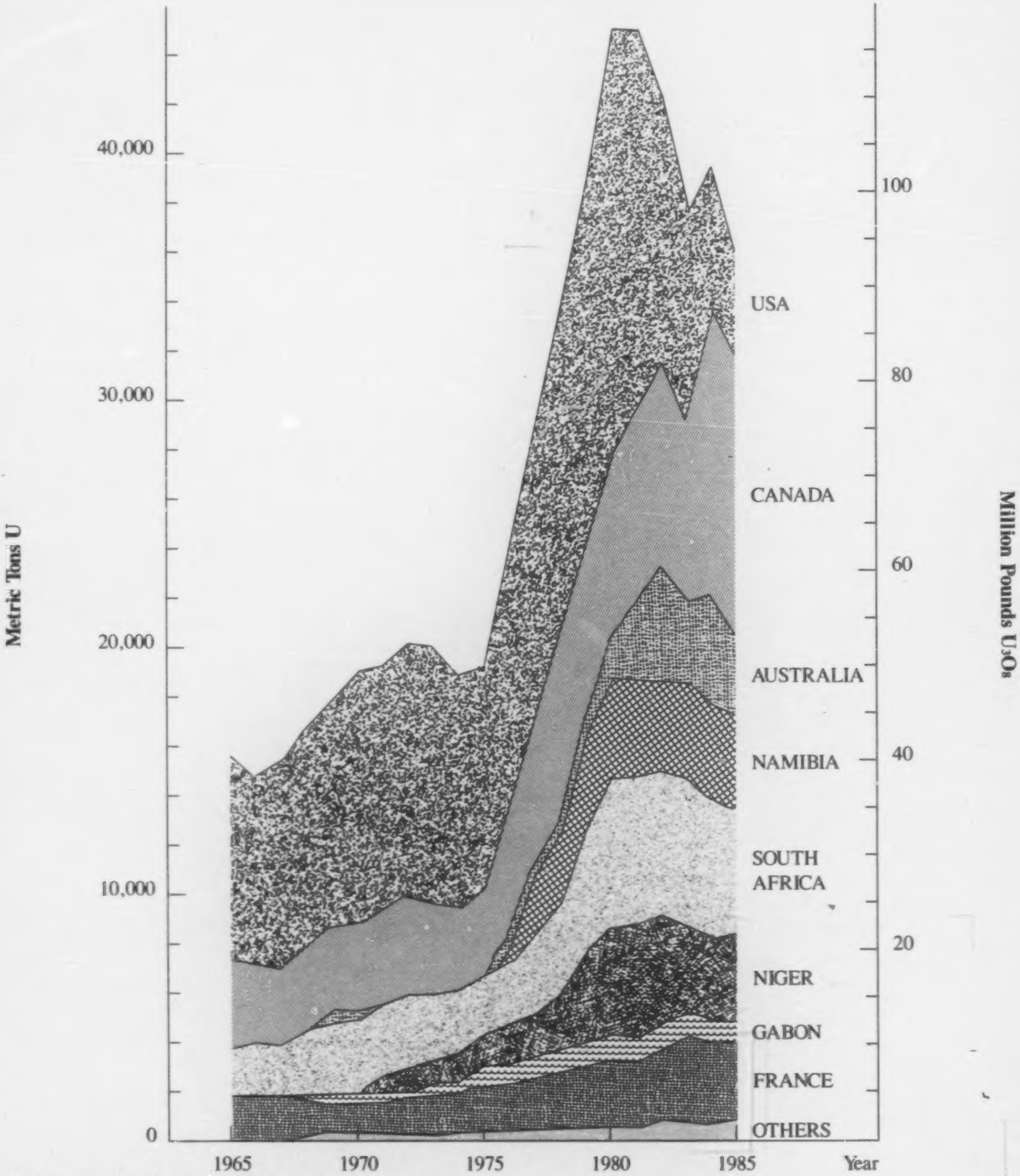
HISTORICAL WOCA[1] URANIUM PRODUCTION[2]
(Compiled by OECD/IAEA Joint Report[3])



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[1] WOCA = World Outside of Centrally-planned Economic Areas.

[2] 1985 production data are preliminary.

[3] A joint report issued biennially by the OECD Nuclear Energy Agency and the International Atomic Energy Agency.

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HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4] Average Price in ECU per pound U_3O_8	Medium or Long-Term Contracts[3,4] Average Price in US Dollars per pound U_3O_8	Spot Contracts[3,4] Average Price in ECU per pound U_3O_8	Spot Contracts[3,4] Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

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[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	202.7
1986	Avg.	155.5	101.5	213.0
Jan	1986	—	109.5	210.5
Feb	1986	—	108.7	210.5
Mar	1986	150.5	99.4	210.5
Apr	1986	—	94.2	210.5
May	1986	—	93.5	210.5
Jun	1986	153.0	95.6	210.5
Jul	1986	—	97.8	215.3
Aug	1986	—	97.9	215.3
Sep	1986	157.0	105.4	215.3
Oct	1986	—	105.9	215.5
Nov	1986	—	104.9	215.7
Dec	1986	161.5	105.2	215.6
Jan	1987	—	106.2	215.9
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2
Apr	1987	—	108.3	222.2
May	1987	—	108.1	222.0
June	1987	167.2	108.1	221.8
July	1987	—	108.7	221.1
Aug	1987	—	110.5	222.3
Sep	1987	170.0	109.3	223.1

P = Preliminary R = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for 1967 to 1986 appear in Report 233.

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CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1986	121.0	130.1	18.16	16.32	15.75	12.16	12.43
Feb	1986	120.8	130.6	19.53	16.67	15.88	12.27	12.36
Mar	1986	120.1	130.9	19.05	16.75	15.82	12.27	12.45
Apr	1986	119.3	131.1	19.39	16.79	15.84	12.33	12.45
May	1986	118.4	131.7	19.55	16.79	15.67	12.41	12.42
Jun	1986	118.6	131.9	19.81	16.73	15.53	12.56	12.40
Jul	1986	118.8	132.9	19.52	16.44	15.37	12.42	12.43
Aug	1986	119.1	133.3	18.40	16.27	15.35	11.98	12.61
Sep	1986	119.4	133.4	19.33	16.72	15.67	12.12	12.81
Oct	1986	119.9	134.0	19.98	16.92	16.00	12.27	12.85
Nov	1986	119.9	134.7	20.12	17.12	16.13	12.35	12.84
Dec	1986	119.7	134.9	19.68	16.90	16.08	12.25	12.90
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.1	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.7	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.0	139.3	19.85R	17.20R	16.25R	12.57R	13.40R
Oct	1987	124.3	139.8	20.06P	17.36P	16.32P	12.96P	13.41P
Nov	1987	—	140.4	—	—	—	—	—

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233, Pages xx to xx..

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.[7]	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.88	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
1985	Avg.	68.76	151.68	192.6	181.2	726,804	396,956
Jan	1986	—	—	213.8	203.6	744,070	449,513
Feb	1986	—	—	215.8	206.9	754,458	438,562
Mar	1986	75.76	167.8	218.3	206.9	759,897	445,387
Apr	1986	—	—	222.2	208.9	756,388	437,563
May	1986	—	—	222.6	212.5	754,788	425,544
Jun	1986	77.65	172.0	224.4	213.3	756,637	462,365
Jul	1986	—	—	228.8	216.3	756,140	516,832
Aug	1986	—	—	232.2	220.3	760,929	502,968
Sep	1986	81.94	181.8	236.7	221.9	765,772	511,363
Oct	1986	—	—	239.3	226.8	763,953	512,897
Nov	1986	—	—	242.4	230.2	761,325	531,509
Dec	1986	85.38	189.9	244.9	232.1	752,264	536,970
Jan	1987	—	—	248.3	233.9	740,031	532,577
Feb	1987	—	—	251.0	237.0	757,872	598,986
Mar	1987	88.17	197.1	255.0	239.6	762,697	536,006
Apr	1987	—	—	258.2	242.5	761,850	533,487
May	1987	—	—	261.2	243.6	759,421R	530,981
Jun	1987	90.74	203.5	263.1	244.9	759,433	573,546
July	1987	—	—	266.2	246.8	681,409	566,232
Aug	1987	—	—	270.0	249.9	—	—
Sep	1987	100.79	224.7	273.4	252.4	—	—

P = Preliminary R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria: "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

UNITED STATES

		Producer Price Index[1]		Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	274.8	268.8	246.8	85.7	10.26	10.63	8.30	6.94
1981	Avg.	304.1	293.4	272.4	94.0	11.55	11.98	9.12	7.62
1982	Avg.	312.3	299.3	289.1	100.0	12.31	12.93	9.96	8.21
1983	Avg.	315.7	303.1	298.4	103.9	12.58	13.43	10.58	8.67
1984	Avg.	322.6	310.3	311.1	107.7	13.05	13.43	11.07	9.04
1985	Avg.	323.8	308.7	322.2	111.2	13.38	13.74	11.56	9.46
1986	Avg.	312.2	299.8	328.4	114.1	13.20	13.49	11.98	9.65
Jan	1986	323.8	308.9	328.4	—	13.41	13.68	11.87	9.58
Feb	1986	318.9	304.4	327.5	—	13.46	13.80	11.83	9.57
Mar	1986	314.0	300.3	326.0	112.9	13.41	13.91	11.80	9.60
Apr	1986	311.6	298.2	325.3	—	13.47	13.89	11.84	9.60
May	1986	311.6	299.2	326.3	—	13.40	13.79	11.90	9.63
Jun	1986	311.8	299.0	327.9	113.7	13.50	13.50	11.95	9.59
Jul	1986	308.5	297.4	328.0	—	13.33	13.30	12.05	9.67
Aug	1986	307.9	297.2	328.6	—	12.96	13.13	11.99	9.64
Sep	1986	308.7	297.5	330.2	114.7	13.04	13.28	12.03	9.70
Oct	1986	309.6	298.4	330.5	—	12.85	13.16	12.08	9.67
Nov	1986	309.8	298.7	330.8	—	12.75	13.14	12.17	9.73
Dec	1986	309.8	298.5	331.1	114.9	12.70	13.03	12.20	9.82
Jan	1987	313.5	300.9	333.1	—	12.94	12.98	12.18	9.84
Feb	1987	314.9	302.2	334.4	—	12.99	12.83	12.21	9.84
Mar	1987	315.7	302.7	335.9	116.1	13.04	12.79	12.24	9.84
Apr	1987	317.3	305.0	337.7	—	13.16	12.90	12.30	9.82
May	1987	318.3	307.1	338.7	—	12.97	12.92	12.31	9.83
Jun	1987	319.9	308.2	340.1	117.2	13.05	12.93	12.27	9.84
Jul	1987	322.1R	309.8R	340.8	—	13.06	13.07	12.37	9.89
Aug	1987	323.8	310.5	342.7	—	13.03	13.07	12.34	9.90
Sep	1987	323.3	310.4	344.4	117.8	13.19R	13.44R	12.56	9.98
Oct	1987	324.9	311.4	345.3	—	12.94P	13.17P	12.53R	9.94R
Nov	1987	325.4	311.9	345.8	—	—	—	12.58P	9.98P

P = Preliminary   R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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GOVERNMENT STATISTICS

AUSTRALIA

Consumer Price Index, All Groups[1]

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	32.4	—	—	31.9	—	—	32.2	—	—	32.7	—	—	32.8
1968	33.3	—	—	32.9	—	—	33.2	—	—	33.3	—	—	33.6
1969	34.2	—	—	33.9	—	—	34.1	—	—	34.3	—	—	34.6
1970	35.6	—	—	34.9	—	—	35.4	—	—	35.6	—	—	36.3
1971	37.7	—	—	36.7	—	—	37.3	—	—	38.0	—	—	38.9
1972	39.9	—	—	39.3	—	—	39.6	—	—	40.2	—	—	40.6
1973	43.7	—	—	41.5	—	—	42.9	—	—	44.4	—	—	46.0
1974	50.3	—	—	47.1	—	—	49.1	—	—	51.6	—	—	53.3
1975	57.9	—	—	55.4	—	—	57.4	—	—	57.8	—	—	61.0
1976	65.7	—	—	62.8	—	—	64.4	—	—	65.9	—	—	69.8
1977	73.8	—	—	71.4	—	—	73.1	—	—	74.5	—	—	76.3
1978	79.7	—	—	77.3	—	—	78.8	—	—	80.4	—	—	82.2
1979	86.9	—	—	83.6	—	—	85.8	—	—	87.8	—	—	90.4
1980	95.8	—	—	92.4	—	—	95.0	—	—	96.8	—	—	98.8
1981	105.0	—	—	101.1	—	—	103.4	—	—	105.5	—	—	109.9
1982	116.7	—	—	111.8	—	—	114.5	—	—	118.5	—	—	122.0
1983	128.5	—	—	124.7	—	—	127.3	—	—	129.4	—	—	132.5
1984	133.6	—	—	132.0	—	—	132.3	—	—	134.0	—	—	135.9
1985	142.6	—	—	137.8	—	—	141.1	—	—	144.2	—	—	147.1
1986	155.5	—	—	150.5	—	—	153.0	—	—	157.0	—	—	161.5

[1] Weighted average of six capital cities for 1967 to 1980. Weighted average for eight capital cities for 1981 to 1987. 1980-81 = 100.0

Price Index of Materials Used in Manufacturing Industries, All Groups[2]

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	—	—	—	—	—	—	—	—	—	—	—	—	—
1968	—	—	—	—	—	—	—	24.8	24.3	23.9	23.8	23.5	23.6
1969	24.5	23.8	24.2	24.3	24.6	24.4	24.5	24.9	24.9	24.8	24.5	24.5	24.6
1970	24.5	24.6	24.7	24.9	25.1	25.0	24.8	24.7	24.2	24.1	23.9	23.7	23.9
1971	24.5	23.9	24.1	24.2	24.3	24.4	24.6	25.1	25.2	24.9	24.7	24.4	24.3
1972	25.5	24.5	24.8	24.8	24.6	24.9	24.9	25.7	26.3	26.4	26.3	26.3	26.3
1973	30.0	26.4	28.5	29.7	29.2	29.4	29.7	30.4	31.4	31.4	31.1	31.4	32.0
1974	34.3	32.6	33.7	33.7	34.4	34.5	33.8	35.2	35.3	34.0	34.5	34.5	34.9
1975	36.3	34.9	34.9	35.2	35.9	35.8	35.4	35.9	36.5	37.3	37.9	37.9	38.1
1976	40.7	38.8	38.9	39.0	39.1	39.5	40.4	41.2	42.0	42.2	42.2	41.4	43.2
1977	46.3	44.3	45.2	46.1	46.6	46.6	46.8	46.7	46.9	47.1	46.8	46.2	47.0
1978	52.0	47.7	48.6	48.4	49.1	49.4	51.2	52.3	53.5	55.1	55.6	56.1	56.9
1979	69.5	59.5	61.1	63.7	66.1	69.6	71.2	72.0	70.8	73.0	74.7	74.9	77.1
1980	83.1	82.1	83.4	82.1	79.3	81.0	81.8	84.0	85.0	84.6	84.1	84.6	84.9
1981	85.9	86.4	86.1	85.7	85.6	85.3	87.0	86.4	87.1	86.5	85.1	84.8	84.5
1982	89.0	85.7	85.8	87.0	88.9	88.9	88.8	89.3	89.9	90.6	91.4	90.7	90.5
1983	96.9	93.1	93.5	95.9	98.3	100.1	100.3	98.6	97.3	97.3	96.0	95.5	96.4
1984	98.0	96.4	97.2	97.5	97.6	97.5	97.7	98.6	99.7	99.4	98.6	98.3	98.0
1985	107.3	98.8	100.4	104.0	106.6	109.7	110.8	110.8	110.2	108.7	108.4	109.4	109.9
1986	101.5	109.5	108.7	99.4	94.2	93.5	95.6	97.8	97.9	105.4	105.9	104.9	105.2

[2] Base of Index: Year 1984/85 = 100.0

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AUSTRALIA

Wage Earners: Indexes of Weekly Award Rates of Pay[3]

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	32.0	31.6	31.6	31.6	31.7	31.7	31.7	32.4	32.4	32.4	32.4	32.5	32.5
1968	33.9	32.6	32.8	32.7	32.7	33.9	34.0	34.0	34.1	34.3	35.2	35.1	35.3
1969	35.6	35.3	35.3	35.3	35.4	35.4	35.5	35.6	35.6	35.7	35.8	35.9	36.7
1970	37.2	36.8	36.9	37.0	37.0	37.0	37.0	37.0	37.2	37.1	37.7	37.8	37.8
1971	41.0	39.6	39.6	39.6	40.1	40.2	40.5	40.7	40.8	42.3	42.6	42.7	42.9
1972	44.2	42.8	42.8	42.9	43.1	44.5	44.7	44.9	44.8	44.9	45.0	45.2	44.5
1973	49.2	45.6	47.1	47.0	47.1	49.4	49.8	50.0	50.4	50.7	50.8	50.9	51.0
1974	67.1	51.2	53.0	62.0	63.2	69.3	69.6	70.3	69.8	72.8	73.6	74.3	76.3
1975	82.1	76.0	76.3	76.5	76.8	79.8	79.5	79.3	79.3	90.1	90.6	90.6	90.6
1976	99.7	91.3	97.1	97.1	97.2	99.6	100.0	100.2	102.0	102.2	102.0	104.0	104.2
1977	110.8	104.7	105.8	108.8	109.1	111.3	111.2	111.3	113.2	113.1	113.1	113.1	114.8
1978	117.7	114.9	116.7	116.8	116.5	116.4	117.7	117.8	117.8	118.0	118.2	118.3	123.5
1979	127.9	123.8	123.9	124.5	124.9	125.5	129.5	129.7	130.4	130.8	130.6	130.3	131.3
1980	140.8	138.6	138.5	138.5	138.6	138.6	138.3	143.1	142.5	142.5	143.0	143.2	143.9
1981	154.1	149.3	149.2	148.9	148.7	154.0	154.5	154.6	154.8	154.8	155.3	157.3	167.3
1982	174.9	169.3	171.1	171.4	171.4	171.9	173.2	177.2	178.2	178.4	178.4	178.5	179.5
1983	181.9	179.6	179.8	179.7	180.1	180.1	180.2	179.9	179.9	179.8	187.8	187.9	187.7
1984	194.4	187.9	187.7	187.5	195.4	196.3	196.7	196.7	196.7	196.7	196.7	197.4	197.4
1985	202.7	197.4	197.8	197.8	202.8	202.4	202.4	202.4	202.9	203.0	202.9	210.4	210.5
1986	213.0	210.5	210.5	210.5	210.5	210.5	210.5	215.3	215.3	215.3	215.5	215.7	215.6

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[3] Base: Weighted Average Minimum Weekly Award Rate, June 1976 = 100.0

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GOVERNMENT STATISTICS

CANADA

Industry Selling Price Index[1], Total Manufacturing Industries (Series D 500000) (1971 = 100)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	90.4	89.6	89.9	90.1	90.2	90.3	90.5	90.5	90.6	90.8	90.8	90.8	91.2
1968	92.3	91.6	91.9	92.1	91.9	91.9	92.3	92.2	92.4	92.7	92.6	93.0	93.3
1969	95.8	94.3	94.7	95.2	95.4	95.8	96.1	95.8	96.0	96.2	96.2	96.5	97.2
1970	98.1	98.1	98.3	98.5	98.6	98.5	98.1	97.8	97.6	97.6	97.9	97.9	97.8
1971	100.0	98.3	98.7	99.0	99.6	99.6	99.9	100.4	100.6	100.7	100.8	100.9	101.2
1972	104.4	102.2	102.8	103.2	103.7	103.9	104.0	104.5	104.7	105.1	105.6	106.1	106.9
1973	116.1	108.7	109.8	111.3	112.4	114.1	115.0	116.7	120.2	119.9	120.6	121.3	122.8
1974	138.1	127.2	129.1	131.1	133.9	135.7	136.7	139.7	141.8	143.1	145.0	147.0	147.4
1975	153.7	149.3	150.0	150.0	151.4	152.8	152.8	153.9	155.2	156.3	157.4	157.3	157.6
1976	161.6	158.4	158.6	159.2	159.9	160.9	161.5	161.9	162.2	163.4	163.4	163.6	165.6
1977	174.3	167.5	168.8	171.1	172.9	173.9	174.1	175.3	175.8	176.9	177.8	178.6	179.2
1978	190.4	181.5	182.8	184.4	187.2	188.0	189.0	190.1	191.7	194.0	197.6	198.6	199.4
1979	217.9	204.8	208.5	210.4	212.8	214.5	216.0	218.3	220.0	223.4	227.4	228.1	230.4
1980	247.2	239.0	240.8	239.5	241.1	242.4	243.7	246.3	249.4	252.0	256.0	257.8	258.4
1981	272.4	263.3	263.7	265.5	267.9	270.0	272.3	274.3	276.2	276.9	279.3	278.8	280.0
1982	288.8	281.9	283.5	284.8	287.7	288.8	289.7	290.3	290.3	292.4	292.1	291.3	292.3
1983	298.7	292.7	293.5	295.2	297.1	298.5	299.3	300.4	301.3	301.1	301.6	301.8	302.9
1984	310.9	305.4	306.6	308.7	310.5	310.6	311.0	312.8	312.7	312.3	312.3	313.6	314.2
1985	319.2	315.9	316.5	318.0	318.3	318.8	319.1	319.3	319.3	319.6	320.8	321.8	323.1

[1] This Index was replaced by the Industrial Product Price Index, Series 613420.

Industrial Product Price Index (Series D 613420) — Total: All Commodities (1981=100)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	33.4	32.9	33.0	33.1	33.1	33.1	33.2	33.2	33.3	33.3	33.3	33.3	33.5
1968	33.9	33.6	33.7	33.8	33.7	33.7	33.9	33.8	33.9	34.0	34.0	34.1	34.3
1969	35.2	34.6	34.8	34.9	35.0	35.2	35.3	35.2	35.2	35.3	35.3	35.4	35.7
1970	36.0	36.0	36.1	36.2	36.2	36.2	36.0	35.9	35.8	35.8	35.9	35.9	35.9
1971	36.7	36.1	36.2	36.3	36.6	36.6	36.7	36.9	36.9	37.0	37.0	37.0	37.2
1972	38.3	37.5	37.7	37.9	38.1	38.1	38.2	38.4	38.4	38.6	38.8	39.0	39.2
1973	42.6	39.9	40.3	40.9	41.3	41.9	42.2	42.8	44.[illegible]	44.0	44.3	44.5	45.1
1974	50.7	46.7	47.4	48.1	49.2	49.8	50.2	51.3	52.1	52.5	53.2	54.0	54.1
1975	56.4	54.8	55.1	55.1	55.6	56.1	56.1	56.5	57.0	57.4	57.8	57.7	57.9
1976	59.3	58.1	58.2	58.4	58.7	59.1	59.3	59.4	59.5	60.0	60.0	60.1	60.8
1977	64.0	61.5	62.0	62.8	63.5	63.8	63.9	64.4	64.5	64.9	65.3	65.6	65.8
1978	69.9	66.6	67.1	67.7	68.7	69.0	69.4	69.8	70.4	71.2	72.5	72.9	73.2
1979	80.0	75.2	76.5	77.2	78.1	78.7	79.3	80.1	80.8	82.0	83.5	83.7	84.6
1980	90.7	87.7	88.4	87.9	88.5	89.0	89.5	90.4	91.6	92.5	94.0	94.6	94.9
1981	100.0	96.2	96.7	97.4	98.3	99.1	100.1	100.8	101.5	101.8	102.7	102.5	102.9
1982	106.7	103.9	104.6	105.3	106.1	106.6	107.3	107.4	107.3	108.0	108.1	107.7	108.0
1983	110.4	108.0	108.0	109.0	109.6	110.0	110.9	111.2	111.5	111.3	111.7	111.6	112.2
1984	115.4	113.2	113.6	114.5	115.1	115.2	115.3	116.3	116.2	116.1	116.1	116.5	116.8
1985	118.6	117.5	117.7	118.4	118.3	118.6	118.6	118.6	118.4	118.6	119.0	119.3	120.0
1986	119.6	121.0	120.8	120.1	119.3	118.4	118.6	118.8	119.1	119.4	119.9	119.9	119.7

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CANADA

Wage Earner Data — Average Hourly Earnings (C$), Firms of All Sizes

Uranium Mines (SIC 057)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1983	17.22	—	—	16.80	16.84	17.03	17.03	16.49	16.94	17.67	17.74	17.83	17.85
1984	17.89	17.75	17.79	18.06	18.07	18.49	18.09	17.82	17.25	17.69	17.65	18.05	17.96
1985	18.53	18.06	18.79	18.25	18.64	19.42	18.50	18.15	17.08	18.54	18.75	19.06	19.08
1986	19.38	18.16	19.53	19.05	19.39	19.55	19.81	19.52	18.40	19.33	19.98	20.12	19.68

Metal Mines (SIC 051—059)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1983	14.86	—	—	14.93	14.49	14.59	14.69	14.44	14.45	14.99	15.37	15.39	15.21
1984	15.85	15.37	15.69	15.62	15.93	15.74	15.58	15.82	15.46	16.06	16.25	16.23	16.49
1985	16.48	16.23	16.51	16.31	16.54	16.61	16.30	16.37	16.13	16.65	16.61	16.76	16.67
1986	16.70	16.32	16.67	16.75	16.79	16.79	16.73	16.44	16.27	16.72	16.92	17.12	16.90

Mines, Quarries, and Oil Wells (SIC 051—099)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1983	14.18	—	—	14.20	14.03	14.00	13.97	13.84	13.80	14.31	14.55	14.57	14.56
1984	14.97	14.64	14.80	14.72	15.00	14.96	14.70	14.82	14.82	15.24	15.16	15.33	15.49
1985	15.56	15.49	15.49	15.46	15.69	15.65	15.50	15.31	15.20	15.61	15.59	15.77	15.90
1986	15.76	15.75	15.88	15.82	15.84	15.67	15.53	15.37	15.35	15.67	16.00	16.13	16.08

Metal Rolling, Casting, and Extruding (SIC 298)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1983	10.67	—	—	10.12	10.69	10.40	10.42	10.41	10.67	10.93	10.62	11.25	11.22
1984	11.11	11.48	11.46	11.43	10.95	10.76	11.01	10.78	10.95	11.14	11.20	11.13	11.01
1985	11.85	11.44	11.70	11.62	11.89	11.91	11.80	11.83	11.98	12.06	12.21	11.99	11.74
1986	12.28	12.16	12.27	12.27	12.33	12.41	12.56	12.42	11.98	12.12	12.27	12.35	12.25

Chemical and Chemical Products Industries (SIC 372—379)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1983	11.10	—	—	10.91	10.94	10.89	10.97	10.96	11.11	11.21	11.22	11.30	11.43
1984	11.68	11.61	11.43	11.50	11.55	11.57	11.60	11.74	11.70	11.82	11.88	11.88	11.91
1985	12.12	11.96	11.98	11.94	11.96	12.07	12.06	12.05	12.11	12.18	12.24	12.40	12.50
1986	12.58	12.43	12.36	12.45	12.45	12.42	12.40	12.43	12.61	12.81	12.85	12.84	12.90

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GOVERNMENT STATISTICS

CANADA

Consumer Price Index

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	36.5	35.8	35.8	35.9	36.2	36.3	36.5	36.8	37.0	36.9	36.9	37.0	37.2
1968	38.0	37.4	37.4	37.5	37.7	37.7	37.9	38.1	38.2	38.3	38.4	38.6	38.7
1969	39.7	38.8	38.8	39.0	39.4	39.5	39.8	40.0	40.1	40.1	40.1	40.3	40.5
1970	41.0	40.6	40.7	40.8	41.0	41.0	41.1	41.3	41.3	41.2	41.2	41.2	41.1
1971	42.2	41.2	41.4	41.5	41.8	42.0	42.1	42.4	42.7	42.6	42.7	42.8	43.1
1972	44.2	43.3	43.4	43.5	43.7	43.8	43.8	44.4	44.7	44.9	44.9	45.0	45.3
1973	47.6	45.7	46.0	46.1	46.6	46.9	47.4	47.8	48.4	48.7	48.8	49.2	49.
1974	52.8	49.9	50.4	50.9	51.2	52.1	52.8	53.1	53.7	54.0	54.5	55.1	55.6
1975	58.5	55.9	56.3	56.6	56.9	57.4	58.2	59.0	59.6	59.7	60.3	60.8	60.9
1976	62.9	61.2	61.5	61.7	62.0	62.5	62.8	63.0	63.3	63.6	64.0	64.2	64.5
1977	67.9	65.0	65.6	66.3	66.7	67.2	67.7	68.3	68.6	69.0	69.6	70.1	70.6
1978	73.9	70.8	71.3	72.1	72.3	73.3	73.9	75.0	75.1	74.9	75.7	76.3	76.5
1979	80.7	77.1	77.8	78.8	79.3	80.1	80.5	81.1	81.4	82.1	82.7	83.5	84.0
1980	88.9	84.5	85.2	86.1	86.6	87.6	88.6	89.3	90.1	90.9	91.7	92.9	93.4
1981	100.0	94.6	95.6	96.8	97.6	98.4	100.0	100.8	101.6	102.3	103.3	104.2	104.7
1982	110.8	105.4	106.7	108.0	108.6	110.1	111.2	111.8	112.3	112.9	113.6	114.4	114.4
1983	117.2	114.1	114.6	115.8	115.8	116.1	117.4	117.9	118.5	118.5	119.2	119.2	119.6
1984	122.3	120.2	120.9	121.2	121.5	121.7	122.2	122.9	122.9	123.0	123.2	124.0	124.1
1985	127.2	124.6	125.4	125.7	126.2	126.5	127.2	127.6	127.8	128.0	128.4	128.9	129.5
1986	132.4	130.1	130.6	130.9	131.1	131.7	131.9	132.9	133.3	133.3	134.0	134.7	134.9

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UNITED STATES

Consumer Price Index[1] — U.S. City Average (All Items - All Urban Consumers)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	100.0	98.6	98.7	98.9	99.1	99.4	99.7	100.2	100.5	100.7	101.0	101.3	101.6
1968	104.2	102.0	102.3	102.8	103.1	103.4	104.0	104.5	104.8	105.1	105.7	106.1	106.4
1969	109.8	106.7	107.1	108.0	108.7	109.0	109.7	110.2	110.7	111.2	111.6	112.2	112.9
1970	116.3	113.3	113.9	114.5	115.2	115.7	116.3	116.7	116.9	117.5	118.1	118.5	119.1
1971	121.3	119.2	119.4	119.8	120.2	120.8	121.5	121.8	122.1	122.2	122.4	122.6	123.1
1972	125.3	123.2	123.8	124.0	124.3	124.7	125.0	125.5	125.7	126.2	126.6	126.9	127.3
1973	133.1	127.7	128.6	129.8	130.7	131.5	132.4	132.7	135.1	135.5	136.6	137.6	138.5
1974	147.7	139.7	141.5	143.1	143.9	145.5	146.9	148.0	149.9	151.7	153.0	154.3	155.4
1975	161.2	156.1	157.2	157.8	158.6	159.3	160.6	162.3	162.8	163.6	164.6	165.6	166.3
1976	170.5	166.7	167.1	167.5	168.2	169.2	170.1	171.1	171.9	172.6	173.3	173.8	174.3
1977	181.5	175.3	177.1	178.2	179.6	180.6	181.8	182.6	183.3	184.0	184.5	185.4	186.1
1978	195.4	187.2	188.4	189.8	191.5	193.3	195.3	196.7	197.8	199.3	200.9	202.0	202.9
1979	217.4	204.7	207.1	209.1	211.5	214.1	216.6	218.9	221.1	223.4	225.4	227.5	229.9
1980	246.8	233.2	236.4	239.8	242.5	244.9	247.6	247.8	249.4	251.7	253.9	256.2	258.4
1981	272.4	260.5	263.2	265.1	266.8	269.0	271.3	274.4	276.5	279.3	279.9	280.7	281.5
1982	289.1	282.5	283.4	283.1	284.3	287.1	290.6	292.2	292.8	293.3	294.1	293.6	292.4
1983	298.4	293.1	293.2	293.4	295.5	297.1	298.1	299.3	300.3	301.8	302.6	303.1	303.5
1984	311.1	305.2	306.6	307.3	308.8	309.7	310.7	311.7	313.0	314.5	315.3	315.3	315.5
1985	322.2	316.1	317.4	318.8	320.1	321.3	322.3	322.8	323.5	324.5	325.5	326.6	327.4
1986	328.4	328.4	327.5	326.0	325.3	326.3	327.9	328.0	328.6	330.2	330.5	330.8	331.1

Producer Price Index[1] — Industrial Commodities

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	100.0	99.5	99.7	99.7	99.6	99.7	99.7	99.7	100.0	100.2	100.5	100.8	101.1
1968	102.5	101.5	102.0	102.2	102.4	102.3	102.4	102.4	102.5	102.8	103.3	103.4	103.8
1969	106.0	104.3	104.9	105.4	105.5	105.5	105.6	105.7	106.1	106.5	107.1	107.4	107.8
1970	110.0	108.3	108.6	108.8	109.3	109.6	109.9	110.1	110.2	110.4	111.2	111.3	111.7
1971	114.1	112.2	112.5	113.0	113.4	113.8	114.0	114.6	115.3	115.1	115.1	115.0	115.5
1972	117.9	115.9	116.5	116.8	117.3	117.6	117.9	118.1	118.5	118.7	118.8	119.1	119.6
1973	125.9	120.0	121.3	122.8	124.2	125.3	126.0	126.1	126.7	127.4	128.5	130.1	132.2
1974	153.8	135.3	138.2	142.4	146.6	150.5	153.6	157.8	161.6	162.9	164.8	165.8	166.1
1975	171.5	167.5	168.4	168.9	169.7	170.3	170.7	171.2	172.2	173.1	174.7	175.4	176.1
1976	182.4	177.4	178.1	179.0	180.1	180.5	181.5	182.7	183.8	184.8	186.3	187.1	187.4
1977	195.1	188.4	190.0	191.7	193.3	194.2	194.7	195.9	196.9	197.8	199.1	199.3	200.0
1978	209.4	201.6	202.9	204.1	206.1	207.4	208.7	210.1	211.4	212.5	214.7	216.0	217.2
1979	236.5	220.0	222.5	225.4	229.0	231.6	234.0	237.5	240.6	244.2	249.0	250.6	253.1
1980	274.8	260.6	265.9	268.6	271.3	271.9	273.5	276.2	278.2	278.8	282.0	283.4	286.6
1981	304.1	291.5	295.7	299.6	303.5	304.7	305.1	306.2	307.2	307.4	309.0	309.3	310.0
1982	312.3	311.8	311.6	311.0	309.9	309.6	310.6	312.8	313.2	312.7	314.3	315.0	315.2
1983	315.7	313.9	313.9	313.5	312.4	313.6	315.3	316.5	317.3	317.1	318.5	318.3	318.4
1984	322.6	319.1	320.6	321.9	322.6	323.2	323.8	323.9	323.3	322.2	323.4	323.8	323.0
1985	323.8	322.9	322.2	322.5	323.8	325.3	324.8	324.4	323.7	322.3	324.2	324.7	325.0
1986	312.2	323.8	318.9	314.0	311.6	311.6	311.8	308.5	307.9	308.7	309.6	309.8	309.8

[1](Bureau of Labor Statistics) 1967 = 100.0

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GOVERNMENT STATISTICS

UNITED STATES

Producer Price Index[2] — All Commodities

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	100.0	100.1	99.9	99.6	99.2	99.7	100.2	100.3	100.0	100.1	100.1	100.1	100.8
1968	102.5	101.1	101.9	102.1	102.1	102.4	102.5	102.8	102.5	102.9	102.9	103.3	103.6
1969	106.5	104.3	104.8	105.4	105.5	106.3	106.8	107.0	106.9	107.1	107.4	108.1	108.6
1970	110.4	109.3	109.7	109.9	110.0	110.0	110.4	110.9	110.4	111.0	110.9	110.9	111.0
1971	114.0	111.8	112.8	113.1	113.4	113.9	114.4	114.7	115.1	114.6	114.5	114.6	115.6
1972	119.1	116.3	117.3	117.4	117.5	118.2	118.8	119.7	119.9	120.2	120.0	120.7	122.9
1973	134.7	124.5	126.9	129.8	130.5	133.2	136.0	134.3	142.1	139.7	138.7	139.2	141.8
1974	160.1	146.6	149.5	151.4	152.7	155.0	155.7	161.7	167.4	167.2	170.2	171.9	171.5
1975	174.9	171.8	171.3	170.4	172.1	173.2	173.7	175.7	176.7	177.7	178.9	178.2	178.7
1976	183.0	179.4	179.4	179.7	181.3	181.9	183.2	184.4	183.8	184.8	185.3	185.6	187.1
1977	194.2	188.1	190.2	192.0	194.3	195.2	194.5	194.8	194.6	195.3	196.3	197.1	198.2
1978	209.3	200.1	202.1	203.7	206.5	208.0	209.6	210.7	210.6	212.4	214.9	215.7	217.5
1979	235.6	220.8	224.1	226.7	230.0	232.0	233.5	236.9	238.3	242.0	245.6	247.2	249.7
1980	268.8	254.9	260.2	261.9	262.8	264.2	265.6	270.4	273.8	274.6	277.8	279.1	280.8
1981	293.4	284.8	287.6	290.3	293.4	294.1	294.8	296.2	296.4	295.7	296.1	295.5	295.8
1982	299.3	298.3	298.6	298.0	298.0	298.6	299.3	300.4	300.2	299.3	299.8	300.3	300.7
1983	303.1	299.9	300.9	300.6	300.6	301.5	302.4	303.2	304.7	305.3	306.0	305.5	306.1
1984	310.3	308.0	308.9	311.0	311.3	311.5	311.3	311.9	310.7	309.3	309.4	310.3	309.8
1985	308.7	309.5	309.1	308.6	309.3	309.8	309.2	309.0	307.3	305.5	307.9	309.5	310.2
1986	299.8	308.9	304.4	300.3	298.2	299.2	299.0	297.4	297.2	297.5	298.4	298.7	298.5

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[2] (Bureau of Labor Statistics) 1967 = 100.0

Chemical and Allied Products, Average Hourly Earnings (SIC 28)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	3.10	3.04	3.05	3.05	3.06	3.07	3.10	3.13	3.12	3.14	3.15	3.16	3.17
1968	3.26	3.20	3.19	3.19	3.22	3.23	3.26	3.28	3.29	3.31	3.31	3.33	3.36
1969	3.47	3.37	3.37	3.38	3.41	3.43	3.46	3.49	3.50	3.52	3.55	3.57	3.58
1970	3.69	3.60	3.60	3.60	3.62	3.64	3.68	3.71	3.73	3.78	3.77	3.79	3.81
1971	3.97	3.84	3.85	3.85	3.90	3.92	3.96	4.02	4.02	4.06	4.04	4.04	4.11
1972	4.26	4.15	4.17	4.17	4.18	4.22	4.25	4.28	4.29	4.35	4.34	4.34	4.38
1973	4.51	4.41	4.40	4.40	4.44	4.46	4.49	4.53	4.54	4.57	4.59	4.62	4.64
1974	4.88	4.67	4.68	4.69	4.75	4.76	4.82	4.91	4.94	5.01	5.04	5.10	5.15
1975	5.39	5.17	5.18	5.21	5.24	5.31	5.37	5.43	5.46	5.51	5.53	5.59	5.63
1976	5.91	5.68	5.71	5.72	5.80	[illegible]	5.87	5.95	5.96	6.05	6.07	6.11	6.16
1977	6.43	6.19	6.20	6.23	6.30	6.33	6.39	6.47	6.49	6.57	6.62	6.66	6.73
1978	7.02	6.78	6.82	6.84	6.87	6.94	6.97	7.05	7.06	7.14	7.20	7.23	7.29
1979	7.60	7.33	7.33	7.37	7.52	7.48	7.54	7.61	7.66	7.74	7.83	7.89	7.93
1980	8.30	7.98	8.01	8.06	8.13	8.18	8.25	8.37	8.40	8.47	8.53	8.60	8.69
1981	9.12	8.75	8.80	8.85	8.95	8.99	9.06	9.16	9.18	9.37	9.36	9.41	9.51
1982	9.96	9.67	9.67	9.70	9.79	9.81	9.94	10.01	10.01	10.19	10.23	10.26	10.32
1983	10.58	10.34	10.42	10.40	10.44	10.50	10.51	10.58	10.61	10.69	10.77	10.84	10.87
1984	11.07	10.88	10.87	10.91	10.94	10.99	11.00	11.09	11.09	11.19	11.28	11.31	11.33
1985	11.56	11.38	11.38	11.36	11.47	11.45	11.51	11.59	11.61	11.66	11.71	11.81	11.86
1986	11.98	11.87	11.83	11.80	11.84	11.90	11.95	12.05	11.99	12.03	12.08	12.17	12.20

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GOVERNMENT STATISTICS

UNITED STATES

Metal Mining, Average Hourly Earnings (SIC 10)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	3.24	3.20	3.20	3.23	3.24	3.23	3.25	3.24	3.24	3.29	3.28	3.28	3.29
1968	3.42	3.31	3.32	3.31	3.37	3.37	3.40	3.41	3.47	3.51	3.48	3.51	3.51
1969	3.64	3.51	3.53	3.54	3.60	3.62	3.64	3.65	3.69	3.72	3.73	3.73	3.74
1970	3.88	3.75	3.77	3.77	3.83	3.85	3.88	3.91	3.91	4.01	3.96	3.99	3.96
1971	4.12	3.95	3.93	3.96	4.03	4.03	4.03	3.99	4.30	4.38	4.30	4.28	4.35
1972	4.56	4.46	4.44	4.46	4.49	4.47	4.48	4.59	4.64	4.69	4.65	4.65	4.68
1973	4.84	4.68	4.71	4.71	4.77	4.74	4.75	4.80	4.85	4.98	4.97	5.00	5.02
1974	5.44	5.10	5.12	5.15	5.29	5.29	5.31	5.36	5.53	5.68	5.75	5.80	5.86
1975	6.13	5.90	5.90	5.89	5.93	6.00	6.02	6.11	6.23	6.35	6.38	6.40	6.44
1976	6.76	6.53	6.51	6.55	6.64	6.63	6.67	6.76	6.89	7.00	6.93	6.99	7.00
1977	7.28	6.95	7.02	7.07	7.12	7.19	7.26	7.32	7.37	7.49	7.52	7.63	7.65
1978	8.23	7.73	7.79	7.84	7.97	8.04	8.08	8.25	8.40	8.56	8.60	8.71	8.72
1979	9.27	8.71	8.81	8.85	9.03	9.06	9.09	9.33	9.39	9.63	9.67	9.79	9.81
1980	10.26	9.92	9.93	9.91	10.01	10.19	10.13	10.24	10.38	10.54	10.58	10.72	10.83
1981	11.55	10.90	11.13	11.11	11.28	11.24	11.29	11.60	11.84	12.10	12.08	12.12	12.07
1982	12.31	12.17	12.22	12.28	12.19	12.21	12.29	12.27	12.31	12.58	12.51	12.55	12.53
1983	12.58	12.56	12.61	12.39	12.51	12.44	12.55	12.59	12.54	12.62	12.68	12.64	12.78
1984	13.05	12.68	12.83	12.89	12.94	13.01	12.99	13.07	13.15	13.24	13.27	13.28	13.32
1985	13.38	13.29	13.31	13.29	13.43	13.24	13.21	13.44	13.55	13.44	13.49	13.49	13.45
1986	13.20	13.41	13.46	13.41	13.47	13.40	13.50	13.33	12.96	13.04	12.85	12.75	12.70

Primary Nonferrous Metals, Average Hourly Earnings (SIC 333)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	3.26	3.18	3.19	3.19	3.20	3.20	3.25	3.27	3.31	3.34	3.34	3.35	3.36
1968	3.48	3.38	3.36	3.38	3.48	3.36	3.45	3.47	3.52	3.53	3.53	3.56	3.58
1969	3.68	3.59	3.58	3.58	3.62	3.64	3.71	3.73	3.73	3.75	3.74	3.75	3.76
1970	3.87	3.78	3.77	3.76	3.80	3.83	3.88	3.94	3.92	3.98	3.90	3.92	3.95
1971	4.15	3.95	3.95	3.95	3.96	3.98	4.15	4.32	4.35	4.34	4.28	4.29	4.40
1972	4.59	4.47	4.45	4.46	4.47	4.47	4.57	4.63	4.65	4.69	4.68	4.73	4.77
1973	4.98	4.79	4.79	4.83	4.82	4.85	4.96	5.03	5.04	5.10	5.12	5.15	5.22
1974	5.63	5.21	5.31	5.43	5.50	5.49	5.59	5.68	5.76	5.83	5.86	5.87	5.93
1975	6.24	5.97	5.96	6.04	6.04	6.07	6.25	6.34	6.40	6.49	6.53	6.52	6.44
1976	6.87	6.54	6.52	6.64	6.74	6.71	6.82	6.91	6.96	7.07	7.10	7.18	7.18
1977	7.67	7.16	7.20	7.24	7.34	7.37	7.71	7.83	7.78	8.01	8.07	8.12	8.15
1978	8.56	8.24	8.28	8.27	8.32	8.36	8.56	8.62	8.66	8.74	8.83	8.86	8.97
1979	9.50	9.00	9.01	9.11	9.49	9.14	9.44	9.57	9.70	9.79	9.87	9.86	9.92
1980	10.63	10.06	10.02	10.24	10.31	10.37	10.70	10.84	10.80	10.95	11.01	11.08	11.33
1981	11.98	11.32	11.36	11.51	11.64	11.70	11.90	12.22	12.12	12.72	12.45	12.51	12.48
1982	12.93	12.69	12.64	12.73	12.72	12.74	12.94	12.94	13.00	13.50	13.25	13.21	13.04
1983	13.43	13.32	13.28	13.33	13.33	13.60	13.37	13.55	13.46	13.45	13.54	13.55	13.32
1984	13.43	13.37	13.33	13.32	13.29	13.36	13.39	13.35	13.51	13.39	13.54	13.76	13.66
1985	13.74	13.71	13.74	13.98	13.63	13.60	13.67	13.83	13.70	13.67	13.65	13.95	13.79
1986	13.49	13.68	13.80	13.91	13.89	13.79	13.50	13.30	13.13	13.28	13.16	13.14	13.03

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GOVERNMENT STATISTICS

UNITED STATES

Electric and Electronic Equipment — Average Hourly Earnings (SIC 36)

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	2.77	2.70	2.72	2.73	2.74	2.76	2.78	2.79	2.78	2.78	2.81	2.83	2.86
1968	2.93	2.87	2.87	2.88	2.87	2.90	2.91	2.92	2.92	2.95	2.98	3.00	3.00
1969	3.09	3.04	3.04	3.04	3.06	3.07	3.08	3.09	3.10	3.13	3.13	3.12	3.16
1970	3.28	3.17	3.20	3.23	3.24	3.26	3.29	3.31	3.30	3.32	3.31	3.33	3.41
1971	3.49	3.42	3.42	3.45	3.45	3.48	3.48	3.50	3.50	3.52	3.52	3.53	3.61
1972	3.71	3.62	3.64	3.65	3.66	3.68	3.69	3.70	3.72	3.76	3.76	3.78	3.83
1973	3.91	3.83	3.82	3.82	3.85	3.86	3.88	3.92	3.95	3.98	3.99	3.99	4.06
1974	4.21	4.05	4.04	4.06	4.06	4.13	4.20	4.22	4.22	4.32	4.37	4.40	4.49
1975	4.64	4.49	4.50	4.54	4.56	4.59	4.64	4.66	4.67	4.73	4.73	4.76	4.83
1976	4.96	4.81	4.81	4.84	4.80	4.86	4.87	4.95	5.00	5.07	5.11	5.13	5.20
1977	5.39	5.23	5.22	5.24	5.26	5.29	5.34	5.39	5.44	5.50	5.51	5.55	5.64
1978	5.82	5.65	5.67	5.67	5.69	5.72	5.74	5.83	5.86	5.94	5.95	5.98	6.10
1979	6.32	6.12	6.14	6.17	6.12	6.22	6.26	6.28	6.36	6.46	6.48	6.51	6.63
1980	6.94	6.66	6.70	6.76	6.78	6.76	6.85	6.94	6.99	7.11	7.16	7.25	7.35
1981	7.62	7.37	7.40	7.44	7.47	7.51	7.57	7.65	7.74	7.76	7.82	7.84	7.92
1982	8.21	8.00	7.98	8.04	8.06	8.09	8.14	8.22	8.29	8.36	8.40	8.43	8.50
1983	8.67	8.52	8.55	8.58	8.58	8.59	8.63	8.70	8.64	8.76	8.74	8.80	8.80
1984	9.04	8.91	8.91	8.94	8.94	8.94	8.96	9.00	9.05	9.13	9.14	9.20	9.32
1985	9.46	9.33	9.32	9.38	9.40	9.39	9.46	9.47	9.49	9.54	9.54	9.59	9.67
1986	9.65	9.58	9.57	9.60	9.60	9.63	9.59	9.67	9.64	9.70	9.67	9.73	9.82

Implicit Price Deflator[3] — Gross National Product

Year	Avg.
1967	35.9
1968	37.7
1969	39.8
1970	42.0
1971	44.4
1972	46.5
1973	49.5
1974	54.0
1975	59.3
1976	63.1
1977	67.3
1978	72.2
1979	78.6
1980	85.7
1981	94.0
1982	100.0
1983	103.9
1984	107.7
1985	111.2
1986	114.1

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[3] (Bureau of Labor Statistics) 1982=100

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U.S. PRIME INTEREST RATE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
1967	5.96	5.75	5.71	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.68	6.00	5.63
1968	6.00	6.00	6.00	6.20	6.50	6.50	6.50	6.50	6.45	6.25	6.25	6.60	6.31
1969	6.95	7.00	7.24	7.50	7.50	8.23	8.50	8.50	8.50	8.50	8.50	8.50	7.95
1970	8.50	8.50	8.39	8.00	8.00	8.00	8.00	8.00	7.83	7.50	7.28	6.92	7.91
1971	6.29	5.88	5.44	5.28	5.46	5.50	5.91	6.00	6.00	5.90	5.53	5.49	5.72
1972	5.18	4.75	4.75	4.97	5.00	5.04	5.25	5.27	5.50	5.73	5.75	5.79	5.25
1973	6.00	6.02	6.30	6.61	7.01	7.49	8.30	9.23	9.86	9.94	9.75	9.75	8.02
1974	9.73	9.21	8.85	10.02	11.25	11.54	11.97	12.00	12.00	11.68	10.83	10.50	10.80
1975	10.05	8.96	7.93	7.50	7.40	7.07	7.15	7.66	7.88	7.96	7.53	7.26	7.86
1976	7.00	6.75	6.75	6.75	6.75	7.20	7.25	7.01	7.00	6.77	6.50	6.35	6.84
1977	6.25	6.25	6.25	6.25	6.41	6.75	6.75	6.83	7.13	7.52	7.75	7.75	6.82
1978	7.93	8.00	8.00	8.00	8.27	8.63	9.00	9.01	9.41	9.94	10.94	11.55	9.06
1979	11.75	11.75	11.75	11.75	11.75	11.65	11.54	11.91	12.90	14.39	15.55	15.30	12.67
1980	15.25	15.63	18.31	19.77	16.57	12.63	11.48	11.12	12.23	13.79	16.06	20.35	15.27
1981	20.16	19.43	18.05	17.15	19.61	20.03	20.39	20.50	20.08	18.45	16.84	15.75	18.87
1982	15.75	16.56	16.50	16.50	16.50	16.50	16.26	14.39	13.50	12.52	11.85	11.50	14.86
1983	11.16	10.98	10.50	10.50	10.50	10.50	10.50	10.89	11.00	11.00	11.00	11.00	10.79
1984	11.00	11.00	11.21	11.93	12.39	12.60	13.00	13.00	12.97	12.58	11.77	11.06	12.04
1985	10.61	10.50	10.50	10.50	10.31	9.78	9.50	9.50	9.50	9.50	9.50	9.50	9.93
1986	9.50	9.50	9.10	8.83	8.50	8.50	8.16	7.90	7.50	7.50	7.50	7.50	8.33
1987	7.50	7.50	7.50	7.75	8.14	8.25	8.25	8.25	8.70	9.07	8.78	8.75P	

U.S. FEDERAL RESERVE DISCOUNT RATE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
1967	4.50	4.50	4.50	4.10	4.00	4.00	4.00	4.00	4.00	4.00	4.18	4.50	4.19
1968	4.50	4.50	4.66	5.20	5.50	5.50	5.50	5.48	5.25	5.25	5.25	5.36	5.16
1969	5.50	5.50	5.50	5.95	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.87
1970	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.85	5.52	5.95
1971	5.23	4.91	4.75	4.75	4.75	4.75	4.88	5.00	5.00	5.00	4.90	4.63	4.88
1972	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
1973	4.77	5.05	5.50	5.50	5.90	6.33	6.98	7.29	7.50	7.50	7.50	7.50	6.44
1974	7.50	7.50	7.50	7.60	8.00	8.00	8.00	8.00	8.00	8.00	8.00	7.81	7.83
1975	7.40	6.82	6.40	6.25	6.12	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.25
1976	5.79	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.43	5.25	5.50
1977	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.27	5.75	5.80	6.00	6.00	5.46
1978	6.37	6.50	6.50	6.50	6.84	7.00	7.23	7.43	7.83	8.26	9.50	9.50	7.46
1979	9.50	9.50	9.50	9.50	9.50	9.50	9.69	10.24	10.70	11.77	12.00	12.00	10.28
1980	12.00	12.52	13.00	13.00	12.94	11.40	10.87	10.00	10.17	11.00	11.47	12.87	11.77
1981	13.00	13.00	13.00	13.00	13.87	14.00	14.00	14.00	14.00	14.00	13.03	12.10	13.42
1982	12.00	12.00	12.00	12.00	12.00	12.00	11.81	10.68	10.00	9.68	9.35	8.73	11.02
1983	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
1984	8.50	8.50	8.50	8.87	9.00	9.00	9.00	9.00	9.00	9.00	8.83	8.37	8.80
1985	8.00	8.00	8.00	8.00	7.81	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.69
1986	7.50	7.50	7.10	6.83	6.50	6.50	6.16	5.82	5.50	5.50	5.50	5.50	6.33
1987	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.93	6.00	6.00	6.00P	

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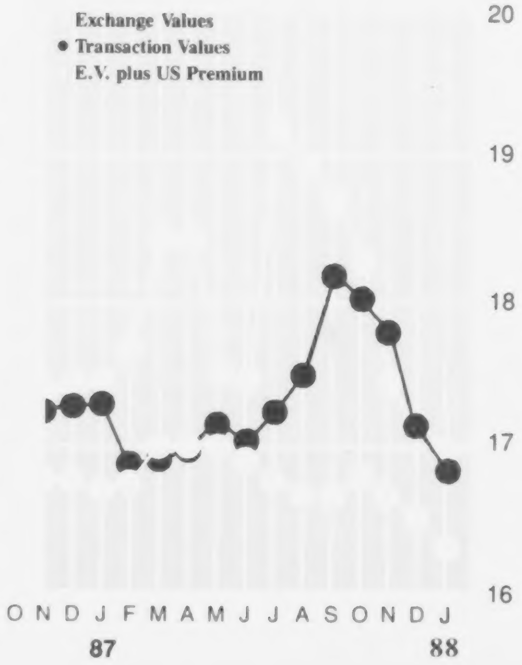

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

February 1988 No. 234

R. GENE CLARK, *EDITOR* CHARLES B. LEWIS, *ASSISTANT EDITOR*

PRICING

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To Our Readers

*   *   *

Nuexco is very pleased to announce that Robert L. Bovey has joined our staff. Bob will be in charge of Nuexco's newly-formed Washington, D.C. office, where he will be responsible for several of Nuexco's new business developments, including providing information and consulting services to US Government agencies, foreign embassies and corporate offices in the Washington area.

Before joining Nuexco, Bob was Director of International Trade Services for the accounting and consulting firm, Coopers and Lybrand. Previously, he served in various positions in Washington, becoming intimately familiar with the government processes that produce the policies controlling the US nuclear industry. These positions included service as Military Assistant to the Secretary of Defense and other high-level government offices.

Bob received his nuclear power training in the Navy, where he worked in submarine engineering and commanded a nuclear submarine, before moving to Washington. He holds a PhD in Operations Research from The Johns Hopkins University.

Nuexco's Washington area office is located in the suburb of Alexandria, Virginia, near the Washington National Airport. The telephone number is (703) 549-0880.

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EXECUTIVE SUMMARY
REPORT 234
(All data as of January 31, 1988)

Exchange Value
\$16.30, down \$0.25

The **Exchange Value** is **\$16.30** per pound U_3O_8, down \$0.25 since last month. The US Premium (relative to the Exchange Value) is \$0.70, up \$0.05 since last month.

UF_6 Value
\$46.50, down \$0.50

The **UF_6 Value** is **\$46.50** per kilogram U as UF_6, down \$0.50 since last month. The US Premium (relative to the UF_6 Value) is \$1.25, down \$0.75 since last month.

Transactions

Eight recent natural uranium sales are reported, involving **8.0 million** pounds equivalent U_3O_8. Six of the sales involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. In addition, two long-term uranium sales are reported. Active spot and near-term **uranium supply** amounts to **5.9 million** pounds U_3O_8 equivalent, up 1.9 million pounds since last month. Active spot and near-term **uranium demand** totals **1.6 million** pounds, down 765,000 pounds from last month. The spot and near-term **supply-demand ratio** increased to **3.6 to 1**.

Transaction Value
\$16.85, down \$0.35

The **Transaction Value** is **\$16.85** per pound U_3O_8, **down \$0.35** since last month. The calculation includes 19 transactions involving a total of 2.4 million pounds U_3O_8 and equivalent UF_6, of which 800,000 pounds are US-origin, and covers a period of 3 months.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged. No loan transactions are reported.

Conversion Value
\$1.90, unchanged

The **Conversion Value** is **\$1.90** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 370 thousand pounds U as UF_6. Active demand totals 200 thousand pounds U as UF_6. Two secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: \$73,
unchanged

The **SWU Value** at .3% tails assay and for delivery within one year is **\$73** per SWU, unchanged since last month. One secondary market SWU transaction is reported.

* * *

Argentina

Although it has only two operating reactors, with a third under construction, Argentina possesses a diverse nuclear industry that includes reactor design and equipment fabrication, heavy water production, uranium mining, enrichment capability, fuel fabrication and reprocessing. Argentina's uranium output has been below reactor requirements in recent years, but increased investment in production could considerably raise production.

Reactors

Twenty six reactors, in ten countries, began commercial operation in 1987, adding approximately 26,000 MWe of nuclear capacity worldwide.

USA

The US Congress has passed a compromise legislation package that directs DOE to focus its efforts to find a site for a high-level nuclear waste repository on Yucca Mountain, Nevada, previously one of three candidate sites.

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NUEXCO REPORT 234 FIGURES OF THE MONTH (January 31, 1988)	This Month (Report 234)	Last Month (Report 233)	12 Months Ago (Report 222)
Exchange Value ($US per pound U_3O_8)	16.30	16.55	16.65
US Premium for the Exchange Value ($US per pound U_3O_8)	0.70	0.65	0.85
UF_6 Value ($US per kilogram U as UF_6)	46.50	47.00	47.75
US Premium for the UF_6 Value ($US per kgU as UF_6)	1.25	2.00	—
Transaction Value ($US per pound U_3O_8 equivalent)	16.85	17.20	17.35
Loan Rate (Per Annum)	3.5%	3.5%	3%
Conversion Value ($US per pound U as UF_6)	1.90	1.90	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	5.9	4.7	3.8
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	1.6	2.4	2.1
Near-Term Supply-Demand Ratio	3.6	2.0	1.8
Recent Uranium Sales:[3]			
Number of Transactions	8	14	4
Quantity of Material (Millions of pounds U_3O_8 equivalent)	8.0	7.0	3.6
Nuexco SWU Value: ($US per SWU):			
at 0.3 tails assay	73	73	80
US DOE SWU Prices: ($US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6[8]: ($US per kgU as UF_6)			
2.5 w/o U_{235}	436	441	459
3.0 w/o U_{235}	557	563	588
3.5 w/o U_{235}	681	688	719
4.0 w/o U_{235}	806	814	852

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[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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January 31, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$16.30**/lb. U_3O_8	5,940	1,630
US Premium	**$0.70**		
UF_6 VALUE	**$46.50**/kgU		
US Premium	**$1.25**		
CONVERSION VALUE	**$1.90**/lb. U as UF_6	370	200
SWU VALUE **0.3 tails assay:**	**$73**/SWU	420	210
LOAN RATE	**3.5%**/annum	8,550	0

TRANSACTION VALUE

$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
16.85	2.4	19	3

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed awillingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of January 31, 1988)

The **Exchange Value** is **$16.30** per pound U_3O_8, down $0.25 since last month. US-origin uranium is commanding a **premium** (relative to the Exchange Value) of **$0.70** per pound U_3O_8 (up $0.05) in the form of concentrates, and **$1.25** per kilogram U (down $0.75) in the form of UF_6. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **5,940,000** pounds U_3O_8 equivalent, up 1,190,000 pounds since last month. The corresponding figure for **active demand** is **1,630,000** pounds, down 765,000 pounds. The spot and near-term supply-demand ratio increased to 3.6 to 1.

The *Current Market Data* section of this Report lists eight natural uranium sales, totaling approximately 8.0 million pounds U_3O_8 equivalent.

The **Transaction Value** is **$16.85** per pound U_3O_8, down $0.35 since last month. The calculation extends over a 3-month period and includes 19 transactions involving 2.4 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$46.50** per kilogram U in UF_6, down $0.50 since last month. Four transactions involving UF_6 are reported, totaling approximately 400,000 pounds equivalent U_3O_8.

The **Conversion Value** is **$1.90** per pound U as UF_6, unchanged since last month. Active supply of secondary market conversion services totals 370,000 pounds U as UF_6. Active demand totals 200,000 pounds U as UF_6. Two secondary market conversion transactions are reported.

The **Loan Rate** is **3.5 percent** per annum, unchanged since last month. No loan transactions are reported.

* * *

The **Exchange Value** declined $0.25, to $16.30 per pound U_3O_8 this month. The U_3O_8 market was relatively quiet during January, and one seller offering substantial discounts below last month's Exchange Value failed to generate buyer interest. What little demand existed was largely discretionary. At least three US utilities have indicated that they were prepared to purchase non-US-origin uranium for 1988 delivery, although none of them appears willing to act quickly, and at least two of those buyers would consider natural UF_6 to meet their requirements.

The spot and near-term market in Europe was quieter during January, primarily for three reasons:

1. The 1987-1988 winter in Europe has been warm; consequently seasonal power demand has been relatively low, reducing fuel requirements.

2. Both the Exchange Value and the US dollar appear to be stable or declining; thus, few buyers are motivated to act because of anticipated price volatility.

3. Several European utilities purchased material on the spot market during 1987, reducing near-term sales opportunities.

In the Far East, no spot market activity has been reported since December, when one utility purchased a substantial quantity of non-US-origin U_3O_8 at a price near the current Exchange Value.

The **Premium** (relative to the Exchange Value) for US-origin U_3O_8 remained relatively stable during January, increasing $0.05, to $0.70 per pound U_3O_8. The slight increase in the US Premium does *not* reflect a strengthening of the market for US-origin material. Rather, the change indicates a level of $17.00 for buyers specifying only US-origin concentrates, a decrease of $0.20 since last month, when the combined Exchange Value and US Premium was $17.20. Two spot and near-term U_3O_8 transactions are reported this month, both of US-origin concentrates, totaling less than 200,000 pounds U_3O_8.

Following the US Supreme Court's decision in early January to review the US Producer vs. DOE litigation, sellers have become more aggressive, but as yet, US producers have been unwilling to offer prices below the $17.00 level. However, with little real demand for US-origin uranium, and weaker prices for non-US-origin material, the $17.00 level is coming under added pressure and could easily break down if sellers unwilling to risk waiting for the resolution of the current political or legal uncertainties decide to move inventories. No buyers in the current market are known to have restricted their inquiries to US-origin material.

US utilities also have reacted to the news of the Supreme Court's review of the Producers vs. DOE lawsuit. Some US utilities that may have considered taking action because of possible restrictions on enrichment of non-US-origin material (such as swapping origins, buying additional US-origin uranium for inventory, or purchasing non-US-origin uranium for near-term enrichment needs), are now considering normal procurement strategies.

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The **UF$_6$ Value** declined $0.50 to $46.50 per kgU as UF$_6$ during January, and three sales of non-US-origin UF$_6$, involving approximately 400,000 pounds equivalent U$_3$O$_8$, are reported, at prices at or below last month's UF$_6$ Value. One large seller of UF$_6$ has concluded several spot sales in recent weeks, and as of the end of January, supply remained stable and the market continued to be relatively active, due to many buyers' preferences for UF$_6$ over U$_3$O$_8$.

The **Premium** (relative to the UF$_6$ Value) for US-origin UF$_6$ declined $0.75, to $1.25. One transaction is reported, involving a small quantity of US-origin UF$_6$. After several months of market activity, utility interest in US-origin UF$_6$ decreased sharply in January, and demand came almost entirely from two US utilities, one of which was nearing a purchasing decision at month's end.

Intermediaries have been the main suppliers of US-origin UF$_6$, although supply has been limited by those companies' ability to obtain UF$_6$ from inventories for spot sales. With relatively smaller supplies of US-origin UF$_6$ available in the spot market, UF$_6$ prices continue to be more volatile those of U$_3$O$_8$, and offering prices decreased in conjunction with weaker demand during January.

The US Producers vs. DOE Lawsuit and the FTA

The outcome of the two main external factors affecting the uranium market — the US Producers vs. DOE lawsuit and the US-Canada Free Trade Agreement (FTA)— are still very much in doubt, although the *minimum* timetables for their resolution are clearer now than they were last month. In early January, the US Supreme Court agreed to hear the US Producers vs. DOE case, but a ruling is not expected before May or June 1988. Thus, no restrictions on DOE's enrichment of non-US-origin uranium are likely to be enforced until at least that time.

The Free Trade Agreement currently is before the US Congress and the Canadian Parliament. In the USA, a coalition of groups from various industries affected by the FTA is opposing passage of the Agreement in its present form. Approval of the FTA depends on Congress passing the required implementing legislation, but the timetable for the implementing bill's introduction into Congress is still uncertain. The Reagan administration wants the bill introduced as soon as possible, but it must be introduced first by the House majority leader (Tom Foley, D-Washington) and then by the Senate majority leader (Robert Byrd, D-West Virginia). Political forces in Congress could forestall its introduction until somewhat later than the administration would like.

In addition, in terms of critical congressional support, passage of the FTA may depend on the prior passage of an omnibus trade bill, which probably will be approved by Congress between March and July 1988. President Reagan has stated that he would veto the omnibus bill, and a number of Canadian politicians have indicated that they might withdraw their support for the FTA if Canada is not exempted from omnibus trade legislation. Thus, the probable outcome of the FTA may not become apparent until at least June 1988. Since neither the Producers vs. DOE lawsuit nor the US-Canada Free Trade Agreement are likely to be resolved until at least mid-year, the near-term uncertainties that have affected the market over the past couple of years are now less pronounced.

* * *

The **Loan Rate** remained unchanged this month, at 3.5 percent per annum. The supply of material available for loan increased substantially in January, even though little or no firm demand for loans exists. No loan transactions are reported this month.

* * *

The **Conversion Value** remained unchanged this month at $1.90 per pound U as UF6. Two secondary market conversion transactions are reported, both by US utilities. Two European utilities currently are evaluating offers for conversion services, and several US utilities are interested in long-term supplies, but overall, near-term demand is weak. Prices for conversion in Europe remain significantly higher than in the USA.

ENRICHED URANIUM AND SWU

The **SWU Value** is $73 per SWU, unchanged since last month. The SWU market was thin in January, with only one buyer firmly in the market for a substantial quantity of SWU. A second buyer was evaluating offers, but represented discretionary demand. One SWU transaction is reported this month, involving a small quantity of SWU bought by a US utility.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Jan 31, 1988)**	**Last Month (Dec 31, 1987)**	**12 Months Ago (Jan 31, 1987)**	**This Month (Jan 31, 1988)**	**Last Month (Dec 31, 1987)**	**12 Months Ago (Jan 31, 1987)**
Australia (dollar)	22.83	22.97	25.16	59.35	59.72	65.41
Belgium (comm. franc)	567.55	552.22	615.98	1,476	1,436	1,601
Canada (dollar)	20.81	21.55	22.33	54.09	56.02	58.05
EEC (ecu)	13.16	12.81	14.42	34.22	33.31	37.49
Finland (markka)	66.07	65.70	74.83	171.77	170.81	194.54
France (franc)	91.52	89.36	99.28	237.94	232.32	258.12
FRG (mark)	27.17	26.40	29.75	70.63	68.62	77.35
Italy (lira)	19,983	19,480	21,213	51,951	50,643	55,149
Japan (yen)	2,070	2,041	2,535	5,382	5,305	6,590
Netherlands (guilder)	30.50	29.71	33.57	79.28	77.23	87.27
South Africa (rand)	32.21	31.92	33.98	83.75	82.98	88.34
Spain (peseta)	1,843	1,801	2,122	4,790	4,683	5,517
Sweden (krona)	97.78	96.50	107.28	254.21	250.88	278.91
Switzerland (franc)	22.10	21.35	25.02	57.44	55.50	65.03
UK (pound)	9.15	8.91	10.83	23.78	23.16	28.14
US (dollar)	16.30	16.55	16.65	42.38	43.03	43.29

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Jan 31, 1988)**	**Last Month (Dec 31, 1987)**	**12 Months Ago (Jan 31, 1987)**	**This Month (Jan 31, 1988)**	**Last Month (Dec 31, 1987)**	**12 Months Ago (Jan 31, 1987)**
Australia (dollar)	23.60	23.87	26.22	61.35	62.06	68.16
Belgium (comm. franc)	586.70	573.91	641.88	1,525	1,492	1,669
Canada (dollar)	21.51	22.40	23.27	55.92	58.22	60.49
EEC (ecu)	13.61	13.32	15.03	35.38	34.62	39.06
Finland (markka)	68.30	68.28	77.98	177.57	177.52	202.72
France (franc)	94.61	92.87	103.46	245.96	241.45	268.97
FRG (mark)	28.08	27.43	31.00	73.01	71.32	80.60
Italy (lira)	20,657	20,245	22,105	53,704	52,632	57,467
Japan (yen)	2,140	2,121	2,642	5,563	5,514	6,868
Netherlands (guilder)	31.52	30.87	34.98	81.96	80.27	90.94
South Africa (rand)	33.30	33.17	35.41	86.57	86.24	92.05
Spain (peseta)	1,905	1,872	2,211	4,952	4,867	5,749
Sweden (krona)	101.08	100.29	111.79	262.78	260.74	290.63
Switzerland (franc)	22.84	22.19	26.07	59.38	57.68	67.77
UK (pound)	9.45	9.26	11.28	24.58	24.07	29.33
US (dollar)	16.85	17.20	17.35	43.81	44.72	45.11

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (Jan 31, 1988)**	**Last Month (Dec 31, 1987)**	**12 Months Ago (Jan 31, 1987)**	**This Month (Jan 31, 1988)**	**Last Month (Dec 31, 1987)**	**12 Months Ago (Jan 31, 1987)**
Australia (dollar)	2.66	2.64	2.72	5.87	5.81	6.00
Belgium (comm. franc)	66.16	63.40	66.59	145.85	139.77	146.81
Canada (dollar)	2.43	2.47	2.41	5.35	5.45	5.32
EEC (ecu)	1.53	1.47	1.56	3.38	3.24	3.44
Finland (markka)	7.70	7.54	8.09	16.98	16.63	17.83
France (franc)	10.67	10.26	10.73	23.52	22.62	23.66
FRG (mark)	3.17	3.03	3.22	6.98	6.68	7.09
Italy (lira)	2,329	2,236	2,293	5,135	4,930	5,056
Japan (yen)	241.30	234.28	274.06	531.98	516.50	604.19
Netherlands (guilder)	3.55	3.41	3.63	7.84	7.52	8.00
South Africa (rand)	3.75	3.66	3.67	8.28	8.08	8.10
Spain (peseta)	214.79	206.81	229.42	473.52	455.95	505.78
Sweden (krona)	11.40	11.08	11.60	25.13	24.42	25.57
Switzerland (franc)	2.58	2.45	2.70	5.68	5.40	5.96
UK (pound)	1.07	1.02	1.17	2.35	2.25	2.58
US (dollar)	1.90	1.90	1.80	4.19	4.19	3.97

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value at 0.30% tails assay (Jan 31, 1988)**	**UF_6 Value per kg.U in UF_6 This Month (Jan 31, 1988)**	**UF_6 Value per kg.U in UF_6 Last Month (Dec 31, 1987)**
Australia (dollar)	102.24	65.12	65.23
Belgium (comm. franc)	2,542	1,619	1,568
Canada (dollar)	93.18	59.35	61.19
EEC (ecu)	58.95	37.55	36.38
Finland (markka)	295.91	188.48	186.58
France (franc)	409.88	261.08	253.77
FRG (mark)	121.67	77.50	74.96
Italy (lira)	89,494	57,006	55,320
Japan (yen)	9,271	5,906	5,795
Netherlands (guilder)	136.58	86.99	84.36
South Africa (rand)	144.27	91.89	90.64
Spain (peseta)	8,252	5,257	5,116
Sweden (krona)	437.91	278.94	274.05
Switzerland (franc)	98.96	63.03	60.62
UK (pound)	40.96	26.09	25.30
US (dollar)	73.00	46.50	47.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4151	1989-98	5,001-10,000	R[3]	Producer	Utility	Transaction occurred in late 1987
4243	1987	less than 50	98—102	Intermediary	Producer	US-Origin
4244	1988	101-300	98—102	Producer	Producer	US-Origin
4249	1988	101-300	98—102	Intermediary	Utility	UF_6
4254	1988	less than 50	98—102	Utility	Intermediary	US-Origin UF_6
4255	1988	50-100	98—102	Intermediary	Utility	UF_6
4256	1988-92	601-1,000	R[3]	Producer	Utility	Transaction occurred in late 1987
4257	1988	101-300	98—102	Producer	Utility	UF_6

---

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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Conversion Services Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks
4245	1988	101-300	93-97	Intermediary	Utility	
4252	1988	101-300	R[3]	Intermediary	Utility	

Enrichment Services Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4251	1988	less than 50	93-97	Intermediary	Utility	R[3]	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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CURRENT MARKET DATA

URANIUM SUPPLY
(January 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1002*	270	—	
87-1005*	200	400 per year	1988-95
87-1023*	500	500 per year	1988-90
87-1061	200	200 per year	UF_6, 1988 on
87-1123	400	—	
87-1130	750	—	
87-1141*	500	200 per year	1989-92
87-1152	200	—	
87-1156	825	—	
87-1161	1,000	1,000 per year	
87-1175	175	—	UF_6
88-1000*	420	—	U_3O_8 or UF_6
88-1001*	200	—	1988
88-1026*	300	—	1988
87-1001	—	400 per year	1989 on
TOTAL:	5,940		
INACTIVE			
87-1017	1,000	—	
87-1053*	100	400 per year	1989 on
87-1135	500	—	
87-1159*	40	—	
87-1019	—	600 per year	1988-91
TOTAL:	1,640		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1059, 1055, 1120, 1142.

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URANIUM DEMAND
(January 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
87-1121	650	650 per year	1988-96
87-1158	150	—	U_3O_8 or UF_6
88-1011*	30	—	UF_6
88-1017*	750	—	1988, UF_{6e}
88-1024*	50	—	1988
87-1013	—	1,200 per year	1990-95
87-1021	—	200 per year	1992 on
87-1108	—	200 per year	1991-2000
87-1134	—	260	1989
87-1150	—	1,000 per year	1989-92
87-1166	—	650	1989, UF_6
87-1172*	—	500 per year	1990 on
TOTAL:	1,630		
INACTIVE			
87-1040*	300	300	1989
87-1114	525	—	
87-1122*	500	—	1988
87-1125	390	—	
87-1146	3	—	
87-1163*	160	—	1989-92
88-1013*	160	—	1988, UF_{6e}
88-1014*	190	—	1988
88-1015*	135	—	1988
88-1022*	—	225	1989, UF_6
TOTAL:	2,463		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1030, 1049, 1138, 1168, 1169, 1174, 1176.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(January 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1012*	2,000	—	
87-1064*	600	—	
87-1071	1,000	—	UF_6
87-1157	4,000	—	
87-1167*	450	—	
88-1023*	500	—	
TOTAL:	8,550		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
TOTAL:	2,000		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 1119.

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CONVERSION SUPPLY AND DEMAND
(January 31, 1988)

	Delivery Period[1] (Thousands of Pounds U as UF_6)		
Nuexco Project Number	**Within 3 Years**	**Beyond 3 Years**	**Remarks**
Available for Sale:			
ACTIVE			
88-1000C*	220	—	
88-1004	150	—	
TOTAL:	370	750	
INACTIVE			
87-1008	750	750	
TOTAL:	750		
Inquiries to Purchase:			
ACTIVE			
88-1020*	120	—	
88-1021*	80	—	
TOTAL:	200		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 1132, 1155, 1160, 1072.

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SWU SUPPLY AND DEMAND
(January 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale: ACTIVE			
87-1058	90	—	1988
87-1068	100	—	1988
88-1006*	230	—	1988
TOTAL:	420		
INACTIVE			
87-1004*	55	—	1988
87-1128*	300	—	1988
TOTAL:	355		
Inquiries to Purchase: ACTIVE			
87-1162*	150	—	1988
88-1017*	160	—	1988
TOTAL:	210		
INACTIVE			
87-1065	150	—	1988
87-1154*	25	—	1988
87-1171	130	—	1988
88-1013*	35	—	1988
TOTAL:	340		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1096, 1116, 1130.

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ARGENTINA'S NUCLEAR INDUSTRY

Introduction

Argentina occupies a somewhat unusual position among the world's nuclear nations, in that, while possessing a rather diverse nuclear industry, it has managed to remain largely outside the system of international controls, and is not a signatory of the Nuclear Non-Proliferation Treaty. Argentina currently has two operating reactors, Atucha Unit 1 (335-MWe PHWR) and Embalse (600-MWe CANDU), with another under unit, Atucha Unit 2 (698-MWe PHWR) under construction. Commercial nuclear development is primarily under the control of the Comision Nacional de Energia Atomica (CNEA), which also manages a modest uranium production industry. Fuel cycle facilities, notably an enrichment plant at Pilcaniyeu and a pilot reprocessing plant at Ezeiza, are under development. Figure 1 shows the locations of Argentina's nuclear industry facilities.

Political Developments

The Argentine nuclear program has benefitted from President Raul Alfonsin's active support, even though it has suffered from funding cutbacks over the past several years. Using nuclear technology and trade as common ground, in 1987, Alfonsin and Brazilian President Jose Sarney began a potentially historic diplomatic initiative, capped by Sarney's visit to Argentina's highly-secret Pilcaniyeu enrichment facility. In the September 1987 mid-term elections, Alfonsin's Radical Party lost its majority to the highly-nationalist Peronist Party, and Alfonsin is scheduled to leave office in 1989. Thus, Alfonsin could face serious challenges during the remainder of his term over decisions affecting the nuclear program.

The Peronists pledge to increase funding to the CNEA, claiming that the present funding level is much too low. Most Argentine political parties would like to increase CNEA's funding, but where the additional money would come from is unclear, since the Argentine economy has been in a severe recession for several years, and government funding levels are generally low.

The CNEA has evolved from a high-priority, high-budget agency under the former military regime to a less-visible position today. The CNEA has about 6,500 employees, roughly 1,000 of which work in the uranium production division. In mid-1987, CNEA President Alberto Constantini resigned after a long-standing dispute with the administration over funding levels. The new CNEA President, Emma Victoria Perez Ferreira, appears to be more inclined to compromise with the central government on budgetary issues.

The funding problems have affected some sectors of the nuclear industry more than others. Atucha Unit 2 (a Kraftwerk Union-designed unit) is about half-completed, but its construction schedule keeps slipping, due to the lack of funding. Perez Ferreira has said that completion is now expected between 1993 and 1995.

As one of the highest-priority government projects, construction at the enrichment facility at Pilcaniyeu is reported to be about on schedule, and the project has been little affected by budget cuts. Alfonsin has stated his intention to increase the project's budget further, increasing the design capacity from the current 20,000 SWU per year to over 100,000 SWU per year.

With little hard currency available to buy uranium or plant equipment abroad, there is a considerable incentive to keep domestic uranium facilities and industrial plants in operation, even when they are uneconomical. Doing so also supports Argentina's "nuclear independence" philosophy, and is, therefore, politically attractive.

The Goal of "Nuclear Independence"

Argentina has made decisions affecting its nuclear program based on the the desire to become independent of any constraints imposed by other countries, and the premise that it will work towards becoming a full-service exporter of nuclear technology. One aspect of nuclear independence is expressed in Argentina's desire to close the fuel cycle, using largely-indigenous and unsafeguarded technologies.

Given its small (three-reactor) nuclear program, consisting exclusively of heavy water reactors, the country's willingness to spend over a billion dollars in developing fuel cycle facilities (including heavy water production) has caused some other countries to question Argentina's motives. Argentina's participation in talks with Iran aimed at restarting Iran's nuclear program has aggravated this situation, as have the occasional press reports that Argentina has been involved in purchases of unsafeguarded nuclear materials.

The rationale for the nuclear program's export orientation assumes that there is a significant market among Third-World countries for unsafeguarded reactors and fuel cycle facilities. Argentina's semi-indigenous "Argos" reactor

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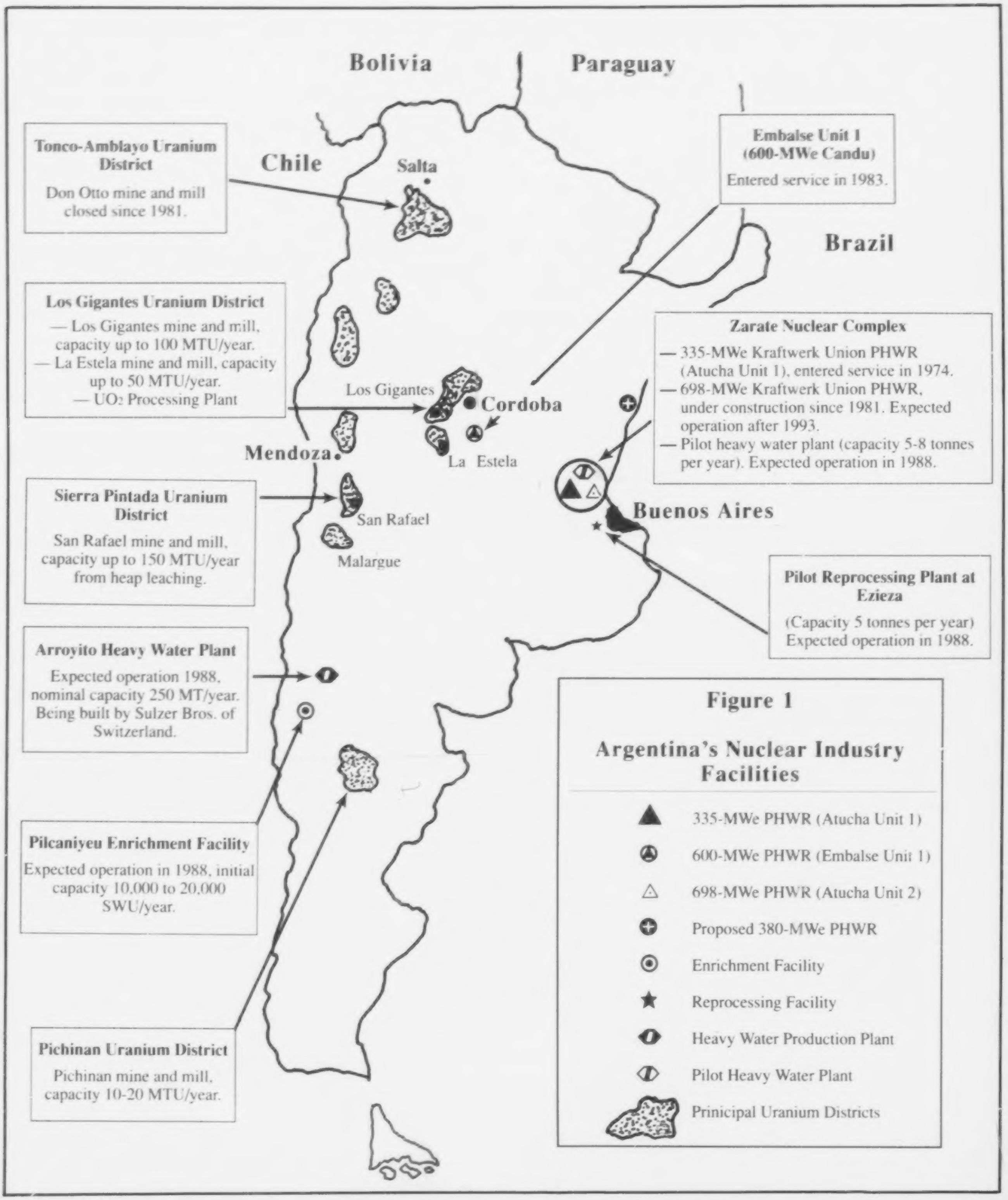
FOCUS


Bolivia
Paraguay
Chile
Salta
Brazil
Los Gigantes
Cordoba
Mendoza
La Estela
Buenos Aires
San Rafael
Malargue
▲ 335-MWe PHWR (Atucha Unit 1)
⊛ 600-MWe PHWR (Embalse Unit 1)
△ 698-MWe PHWR (Atucha Unit 2)
⊕ Proposed 380-MWe PHWR
⊙ Enrichment Facility
★ Reprocessing Facility
Heavy Water Production Plant
Pilot Heavy Water Plant
Prinicipal Uranium Districts

Tonco-Amblayo Uranium District

Don Otto mine and mill closed since 1981.

Los Gigantes Uranium District

— Los Gigantes mine and mill, capacity up to 100 MTU/year.
— La Estela mine and mill, capacity up to 50 MTU/year.
— UO_2 Processing Plant

Sierra Pintada Uranium District

San Rafael mine and mill, capacity up to 150 MTU/year from heap leaching.

Arroyito Heavy Water Plant

Expected operation 1988, nominal capacity 250 MT/year. Being built by Sulzer Bros. of Switzerland.

Pilcaniyeu Enrichment Facility

Expected operation in 1988, initial capacity 10,000 to 20,000 SWU/year.

Pichinan Uranium District

Pichinan mine and mill, capacity 10-20 MTU/year.

Embalse Unit 1 (600-MWe Candu)

Entered service in 1983.

Zarate Nuclear Complex

— 335-MWe Kraftwerk Union PHWR (Atucha Unit 1), entered service in 1974.
— 698-MWe Kraftwerk Union PHWR, under construction since 1981. Expected operation after 1993.
— Pilot heavy water plant (capacity 5-8 tonnes per year). Expected operation in 1988.

Pilot Reprocessing Plant at Ezieza

(Capacity 5 tonnes per year) Expected operation in 1988.

Figure 1

Argentina's Nuclear Industry Facilities

design, in addition to having been created to fill the niche in Argentina's planning for a fourth reactor, is also meant to compete in the PHWR export market, dominated by Atomic Energy of Canada's (AECL) CANDU line and Kraftwerk Union's (KWU) designs (from which the Argos is derived).

Another example is the pilot heavy water plant at Zarate, site of the Atucha reactors. In the mid-1970s, the plant was started because CNEA believed that foreign suppliers would be unwilling to sell Argentina a large-scale heavy water plant. However, in 1979, Switzerland's Sulzer Bros. agreed to build the 250 tonne-per-year facility now nearing completion at Arroyito (using the monothermal ammonia-hydrogen exchange process). The rationale for continuing to build the small and very expensive (estimated $100 million) water-hydrogen sulfide process pilot plant was that it would provide experience for eventual export of the design (uprated to the 50 to 100 tonne-per-year range). The Argentine design would not carry safeguards, and presumably would find a market in the Third World. Such logic is problematic, in that the only likely customers would be ones buying Argentina's Argos PHWR reactor. Even then, hypothetical buyers would need other sources of heavy water supply as well, because the unit's relatively small size would not supply all reactor requirements.

Uranium Production

Between 1978 and 1987, uranium production in Argentina ranged between 253,000 and 486,000 pounds U_3O_8 per year (Figure 2). Production has dropped each year since 1983, when it was 448,000 pounds U_3O_8, to an estimated 253,000 pounds in 1987. Thus, recent output has been somewhat below that needed to provide fuel for the two

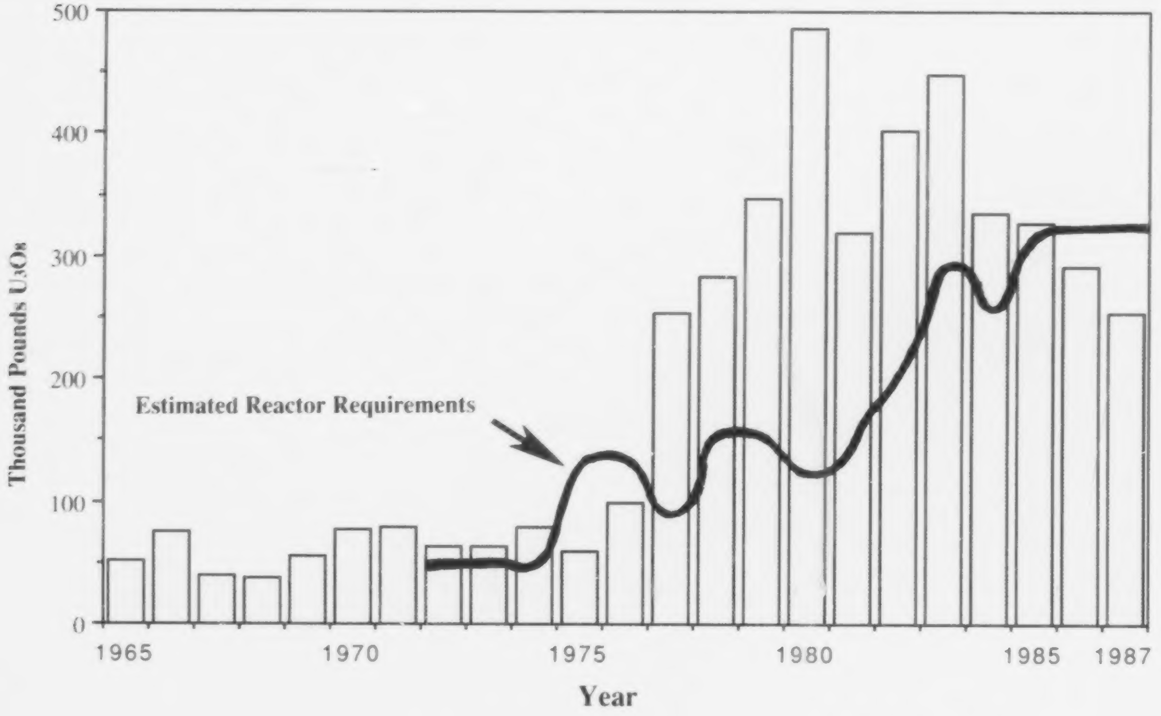


Figure 2
URANIUM PRODUCTION IN ARGENTINA

*Source: up to 1985, CNEA. 1986 and 1987 figures are Nuexco estimates.

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operating reactors, although it is estimated that Argentina has about a two-year forward supply of uranium in inventory. In 1985 and 1986, total uranium requirements for the Atucha 1 and Embalse reactors were about 325,000 pounds U_3O_8 per year. To date, Argentina's uranium production efforts have primarily been aimed at achieving self-sufficiency.

Some foreign observers have predicted that Argentina will face a uranium shortage in the 1990s, when Atucha Unit 2 and possibly another planned unit will enter service. When Atucha Unit 2 comes on line, it will increase annual uranium requirements by about 260,000 pounds U_3O_8. However, if a significant investment is made to increase production in the Sierra Pintada orebody, Argentina should be able to meet its domestic uranium needs in the future.

Total uranium reserves are thought to be about 520 million pounds U_3O_8, of which only about 50 million pounds are considered Reasonably Assured Resources (RAR) and about 39 million pounds are accessible at under $36 per pound ($80/kg)*. The main deposits are at Los Gigantes (Cordoba Province), Sierra Picinan (Chubut Province), Sierra Pintada (Mendoza Province) and Tonco-Amblayo (Salta Province). Argentine official sources say that most uranium is recovered for about $20 per pound, with costs higher than that at Los Gigantes, where CNEA has said it is losing money. Argentine law stipulates that all uranium reserves are the exclusive property of CNEA, held and operated on behalf of the federal government.

At present, there are three operating uranium mines in Argentina.

1. *San Rafael* — Located near the Sierra Pintada orebody in Mcdoza Province, about 150 miles (250 km) south of the provincial capital of Mendoza, this mine produces uranium from heap leaching, with a current capacity of about 300,000 pounds U_3O_8 per year. 1987 production was approximately 140,000 pounds U_3O_8. Its heap-leaching recovery method probably is somewhat cheaper than conventional milling, but offers less efficient uranium recovery.

The government has decided to focus its future uranium production efforts on the Sierra Pintada orebody, and is considering expanding leaching capacity to about 650,000 pounds U_3O_8 per year. This orebody contains Argentina's largest uranium reserves — some 42 million pounds U_3O_8. Expansion of mining operations in the field was scheduled to begin in 1990, but now has been indefinitely deferred. In 1986, President Alfonsin reportedly approached Japan about financing and building a 1.8 million pounds U_3O_8 per year mine and mill at Sierra Pintada, to cost about $160 million. Whether the Japanese will help in this area has not been reported.

2. *Los Gigantes* — Los Gigantes is located in Cordoba Province, about 300 miles (500 km) northwest of Buenos Aires. The mine began producing uranium in late 1982, and is operated by Eduardo Sanchez Granel y Asociados, which sells its production to CNEA under a 15-year contract that specifies deliveries of 260,000 pounds U_3O_8 per year. Target 1987 production was 150,000 pounds, but it is estimated that about 90,000 pounds actually was produced. Since opening in December 1982, the mine's output has averaged about 115,000 pounds U_3O_8 per year, even though milling capacity is over 250,000 pounds per year. In late 1986 through early 1987, the operation was closed for several months due to charges by the Cordoba Provincial government that it was ignoring environmental regulations. The project probably will continue to produce at less than target levels until its contract expires in 1997, when it likely will be closed.

3. *La Estela* — This mine is in San Luis Province, about 400 miles (650 km) west of Buenos Aires. The provincial government recently signed an agreement with the CNEA giving the province a royalty income from the mine of about $2.4 million per year, or about 7.5 percent of Argentina's total uranium royalty earnings. 1987 production from the La Estela mine and mill was about 26,000 pounds U_3O_8.

The CNEA is concerned that Argentina's uranium production could greatly decrease after about 1990, when it is possible that the Los Gigantes and La Estela mines will have to close down after having exhausted their available resources, leaving only San Rafael in operation. The CNEA closed its 22-year-old Malargue mine and mill in southern Mendoza Province in 1986, and the Don Otto and Pichinan facilities (total capacity about 280,000 pounds per year) are no longer operating. The Don Otto facility includes a mill and several nearby mines, and is in the far northwest in Salta Province. The Pichinan mine and mill is in Patagonia, in Chubut Province, about 900 miles (1,500 km) southwest of Buenos Aires. This possibility of a further reduction of output in the near-term has made the option of enriching the natural uranium fuel loaded into its PHWRs increasingly attractive — even comparatively

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* *Uranium Resources, Production and Demand*, prepared by the OECD Nuclear Energy Agency and the International Atomic Energy Agency, 1986.

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slight enrichment levels (0.85 to 1.2 percent U_{235}) could increase burnup in the reactors enough to conserve measurable amounts of uranium.

The Reactor Program

Nuclear-generated electricity accounted for about 11 percent of the total in 1985 and 1986. In addition to the two operating commercial units (and one under construction), Argentina also has four research reactors, and the government is studying proposals to build a 22-MWt isotope production reactor, designated RA-9. For commercial electricity production, Argentina appears firmly committed to the PHWR reactor type.

Argentina's first reactor was Atucha Unit 1, a KWU-designed 335-MWe (Net) PHWR that entered service in 1974. The Atucha complex is located at Zarate, about 45 miles (70 km) northwest of Buenos Aires. The reactor is used for daily load cycling, and through the end of 1986, its cumulative lifetime load factor was 71.5 percent. It uses approximately 300 MT of heavy water in its core, with a 27 tonne reserve. CNEA estimates that enriching the reactor's natural uranium fuel to 1.2 percent U_{235} would double the current burnup of 6,000 MW days per tonne.

In 1983, a second PHWR, a 600-MWe CANDU designed by AECL, went into operation at Embalse, near Cordoba. Lifetime cumulative load factor at the end of 1986 was 53.5 percent.

The second unit at the Atucha site (698-MWe net PHWR) currently is about half completed and is now tentatively scheduled to go into operation in 1993. The plant's architect/engineer is ENACE (Empresa Nuclear Argentina de Centrales Electricas) which is 25-percent owned by KWU and the remainder by the CNEA. The design was supplied by KWU.

The reactor's pressure vessel arrived on-site in March 1987. The main part of the vessel was forged in Japan by Mitsubishi Heavy Industries, and was then shipped to Rotterdam, Holland, where the 320-tonne cover dome from Spain was installed and final assembly was completed. The vessel is one of the largest ever made; it is 14.26 m in height, 8.44 m in diameter, has an average wall thickness of about 280 mm and weighs 997 tonnes.

Construction at the Atucha site has frequently been interrupted. Shortly after construction began in 1981, the economic crisis brought on by the Falklands War in 1982 caused delays, and between 1984 and 1986 construction virtually stopped. The project has suffered from the lack of a continuous funding commitment from the central government, and budgets have been approved only on a year-by-year basis. In May 1987, 6,500 workers occupied the worksite, protesting low wages and intermittent pay. A recent ENACE estimate put the final cost of the reactor at a minimum of $2.6 billion, excluding interest on the project-related loans, which could run as high as 30 percent of capital costs. The plant will import at least $900 million in equipment and services from abroad, primarily from the Federal Republic of Germany (FRG) through KWU.

Argentina also tentatively plans to build a PHWR of approximately 380 MWe in the mid to late-1990s at Hernandarias, in Entre Rios Province, northwest of Buenos Aires. There is considerable doubt that this planned unit will ever be built, given the lengthy and expensive delays in completing Atucha Unit 2. Current plans call for this to be the demonstration unit for Argentina's semi-indigenous "Argos" reactor design.

Even before any of these newly-designed reactors are built domestically, Argentina has been involved in marketing the Argos design abroad. The design is similar to Argentina's two Kraftwerk Union PHWRs and is reported to have a high degree of inherent safety. It's small capacity clearly defines its market as Third-World countries with small electricity grids and limited nuclear infrastructure. The price appears to be in the $1 billion range, and the design competes with Canada's Candu-300 and KWU's designs. Prospective customers certainly are aware that buying a reactor from Argentina would not put the customer into a restrictive safeguards environment, unlike the situation if a reactor was bought from Canada or the USA. Argentina has discussed its design with the governments of Algeria, Albania, and other countries that might be candidates for a reactor purchase.

Fuel Cycle Facilities

Enrichment — In 1983, Argentina revealed that it was building a pilot enrichment plant at Pilcaniyeu, 700 miles (1,150 km) southwest of Buenos Aires near the resort area of San Carlos de Bariloche. The plant's initial capacity is reported to be under 10,000 SWU per year; it uses gaseous diffusion technology. It is scheduled to begin operation in mid-1988, with an expansion to 20,000 SWU per year planned to begin in 1989. Funding for expansion to 100,000 SWU per year could be approved even before

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1989. The plant's cost is estimated to be approximately $200 million thus far.

The Argentine government had said for several years that the plant's target enrichment level was 20-percent U_{235}, but then in 1986, it announced that, due to economic restrictions, the target enrichment had been downgraded to only 2 percent. However, several other sources have been quoted as saying that the 20-percent figure remains correct, and that only international sensitivities to higher enrichment levels caused the government to modify its numbers. It is equally possible that unresolved technical problems may have forced down the initial enrichment target.

At a 20-percent enrichment level, 20,000 SWU could provide over 500 kilograms of enriched UF_6. This capacity also could provide nearly 40 tonnes of enriched UF_6 at the 1.2 percent sometimes quoted as a possible enrichment level for Argentina's PHWRs. Thus, Argentina could consume this amount of enrichment internally, but, because its reactors do not *require* enriched fuel, there is always the potential for export. How the enrichment capacity is to be used has not been reported.

The Pilcaniyeu project is under extremely tight security, and is accorded a high degree of priority at the central government level. The project also is important as an example of Argentine technical expertise and independence from larger countries. Several reasons have been given for this costly effort to achieve domestic enrichment capability:

1. Closing the fuel cycle would enable Argentina to end its dependence on outside suppliers for enrichment.
2. Domestic enrichment of Argentina's reactor fuel could preserve Argentina's uranium reserves.
3. Having enrichment capacity would allow Argentina to export unsafeguarded fuel for any reactors, commercial or research, that it (or others) might sell .
4. It would support fuel requirements (estimated at 30 kg per year of 20-percent enriched U_{235}) for its four research reactors.

Argentina reportedly has purchased enrichment services abroad, including a purchase in 1982 of 100 kg of uranium enriched to 20-percent U_{235} in the USSR. News reports from Buenos Aires also have claimed that Argentina has purchased unsafeguarded UF_6 from the People's Republic of China in the early 1980s, although CNEA denies this.

Reprocessing — CNEA is constructing a pilot reprocessing plant at Ezeiza, near Buenos Aires, which is over 80-percent complete. It uses technology acquired from Italy's Technint SpA. for basic engineering. The plant is scheduled for cold testing during the second half of 1988 and for hot-testing and initial use on spent fuel from Atucha-1 in 1989. Initially, the pilot plant's capacity will be 5 tonnes of spent fuel per year, recovering up to 15 kg of plutonium. At the end of 1986, Argentina reportedly had in storage approximately 4,200 spent fuel assemblies (containing about 1,700 kg of plutonium) taken from Atucha Unit 1 since 1974. The reprocessing plant will have a capacity of about 30 such assemblies per year.

Fuel Fabrication — A fuel fabrication unit also is being built at the Ezeiza facility, with zircaloy production scheduled for 1990. CNEA closed its pilot zirconium sponge plant in 1982 to concentrate on building a larger-scale unit. A UO_2 plant is in operation in Cordoba Province, apparently processing all domestic U_3O_8 for fabrication. In 1984, Argentina reportedly sold Romania fuel fabrication machinery to be used with Romania's CANDU reactors.

Heavy Water — Argentina currently has a pilot heavy water (D_2O) production plant under construction at Zarate, site of the Atucha reactors, and a full-scale plant at Arroyito, in Neuquen Province. The Zarate plant, with a capacity of 2 to 8 tonnes per year, has been under construction since the mid-1970s, and it is scheduled to begin operation in mid-1988, using the water-hydrogen sulfide ion exchange process, at an estimated cost of $100 million. It does not operate under any IAEA or other safeguards. The plant is intended as a demonstration unit; the design will be upgraded to the 80 tonne per year range, so that it can eventually be exported.

The contract for the Arroyito facility was signed with Sulzer Bros. of Switzerland in 1980, and totaled approximately $300 million at the time. The cost now reportedly is more than double the original figure. Sulzer hopes to finish the twin 125 tonnes-per-year production lines in 1988, with production beginning in mid-1989. Capacity will be about 100 tonnes for the first year, rising to about 150 tonnes the second year, and averaging about 200 tonnes thereafter. The plant includes an ammonia production facility to feed the monothermal exchange process. The facility will be operated under safeguards.

Argentina's commerce in heavy water has captured the attention of the nuclear press on several occasions over the past few years. In 1983, Argentina reportedly bought about

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5 tonnes of unsafeguarded heavy water from China. There were reports that the material did not meet required specifications for isotopic purity, but that Argentina has kept it for additional purification in a production plant, when one comes into operation. Also in 1983, the Reagan administration approved the sale from the US Government to Argentina of approximately 40 tonnes (of the roughly 140 tonnes available) of heavy water which was several decades old. In 1986, China sold two tonnes of heavy water to Argentina, this time under full safeguards, for a price of around $245 per kg. The Embalse reactor's core, for example, requires 468 tonnes of heavy water.

Nuclear Trade and International Cooperation

Brazil — Over the last several years Argentina and Brazil have made considerable progress in defining areas of mutual nuclear-industry cooperation, and have used the potential for such cooperation to try to diffuse traditional tensions between the two countries. Argentine President Raul Alfonsin and Brazilian President Jose Sarney first agreed on limited nuclear cooperation in 1985. Then, in January 1987, executives from Argentina's ENACE and Brazil's Nuclen (the construction subsidiary of Nuclebras) signed an agreement to cooperate in such areas as fuel management, nuclear plant design and engineering, and related services.

This type of agreement was designed to stimulate closer ties between the two countries in the nuclear arena. Both companies are quasi-governmental organizations with a common link in that KWU is a 25-percent owner in each. KWU exerts considerable influence because it manages the technology transfer to the nuclear projects undertaken by both government-owned companies.

In March 1987, a representative of Brazil's CNEN (Commissao Nacional de Energia Nuclear) announced that Brazil and Argentina had agreed in principle to cooperate on long-term development of a small fast breeder reactor. At about the same time, the two countries began discussing the possibilities for cooperation on development of a reactor to power nuclear submarines. Such cooperation could greatly enhance communication between the militaries of both countries.

In April 1987, representatives of the two countries conducted high-level political and technical discussions in Rio de Janiero, covering a wide range of topics. As a result of those talks, Argentina's Alfonsin invited President Sarney to visit Argentina's Pilcaniyeu enrichment plant. The Brazilian President's visit to Pilcaniyeu in July made him only the second foreigner known to have visited the facility; the other visit was by IAEA Director General Hans Blix, who toured the facility shortly after its existence was announced in November 1983. As a result of Sarney's visit, trust between the two countries' presidents appears to have increased, even though Alfonsin was attacked in certain circles for having compromised Argentine proprietary enrichment technology. Brazil is thought to be at least five years behind Argentina in indigenous, unsafeguarded fuel cycle technology, particularly enrichment.

Following Sarney's visit to Argentina, Alfonsin announced that Argentina would supply low and medium-enriched uranium to Brazil sometime later in the 1980s, which Brazil would use to fuel its Angra-1 reactor and one or more of its research reactors. This announcement served as a tacit acknowledgement of Brazil's inability to provide the necessary enrichment levels from its own domestic enrichment facilities. However, only a few days later, Brazil proposed supplying Argentina with an unspecified amount of slightly-enriched uranium (0.85 percent U_{235}) from its Rezende jet-nozzle enrichment plant, which is under safeguards through an arrangement with West Germany. The material would be used to increase burnup at the Atucha-1 reactor.

Canada — Until fairly recently, Argentina maintained close ties with Canada's AECL, which supplied the 600-MWe Candu reactor at Embalse that has been operating since 1983. In 1978, Canada lost the bid to provide the second unit at the Atucha station to KWU, even though Argentina reportedly preferred the CANDU design because it was better suited to local fabrication. Argentina had insisted on using local companies to produce at least part of the plant equipment. Canada's Ministry of External Affairs had required full-scope safeguards conditions that the Argentine government did not accept, such as Argentina's signing the Nuclear Non-Proliferation Treaty. In addition, Canada would not permit re-export of the pressure-tube reactor design (a condition agreed to by KWU in supplying Atucha Unit 2). Canada's stringent safeguards requirements continue to limit cooperation between the two countries.

Although AECL has continued to supply heavy water and parts for Embalse, the Canadian government has not thus far been willing to modify its regulations so as to permit the possibility of additional CANDU sales to Argentina. As recently as November 1987, discussions over a possible Argentine purchase of Canadian uranium, as well as other

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nuclear trade, were canceled when it became obvious that Canada's stance would not be acceptable to Argentina.

Federal Republic of Germany — Argentina has developed a close relationship with the FRG in the area of nuclear power. Kraftwerk Union is a one-fourth partner in ENACE, which is the project manager for Atucha Unit 2, designed and partially supplied by KWU. The lengthy construction delays at Atucha Unit 2 have strained the relationship with KWU, due in part to contract renegotiations concerning Argentina's role in fabricating equipment, and also over the need for KWU to provide additional loans to keep the project moving, however slowly. Argentina has admitted the need to have a "long-term partner" that will provide technology transfer and help with export-related opportunities. Despite frustrations, the FRG and KWU appear to have assumed that role.

Iran — Argentina's continuing talks with the government of Iran over nuclear issues and possible construction arrangements have received considerable attention in the more established nuclear nations. The two countries have discussed Argentina's possibly helping to rebuild Iran's single research reactor, potentially supplying another research unit, and possibly helping finish construction of Iran's never-completed Bushehr reactor. The research unit is a safeguarded 5-MWt pool-type, water-moderated unit originally supplied by the USA, which uses 93-percent enriched uranium. Argentina's relationship with Iran's Atomic Energy Organization has been of growing concern not only to nuclear observers in Washington, but to some nuclear industry personnel in Argentina as well.

In May 1987, Argentina reportedly signed a nuclear cooperation agreement with Iran that included an agreement to supply a new core for the research reactor, a contract worth about $5 million to Invap (Investigaciones Aplicadas, half-owned by the CNEA and half by the Rio Negro provincial government), the company responsible for construction of the Pilcaniyeu enrichment plant. The supply deal involves fuel enriched to 20-percent U_{235} and some training of Iranian personnel in Argentina.

Argentina had for some time previously been reported as one of the partners in a West German (KWU)-Spanish-Argentine consortium bidding to complete work on the Bushehr reactor, and Argentine technicians have visited the Bushehr site. In November 1987, President Alfonsin reportedly approved the Argentine involvement in bidding for nuclear equipment and services supply contracts with Iran. However, Iraq's recent bombings of the Bushehr reactor now have curtailed any near-term plans to resume construction at Bushehr.

Peru — Since 1978, CNEA has acted as project manager at the Peruvian Huarangal Nuclear Complex near Lima, now scheduled to begin operating in 1988. CNEA designed and built a 10-MWt pool-type reactor for isotope production, and a zero-power research reactor. The complex will produce radioisotopes for medicine and agriculture, including food irradiation. Between 1982 and 1986, the project was largely interrupted by political turbulence in both countries. The Peruvian isotope production reactor will use 40-kg core loads of 20-percent enriched fuel, to be supplied by Argentina from the Pilcaniyeu plant. The fuel for the initial core was enriched in the FRG from Argentine uranium.

Algeria and Albania — Argentina has met with Algerian representatives concerning possible sale of Argentina's Argos PHWR design. In May 1985, Algeria reportedly purchased a 500-KWt research reactor from an Argentine consortium led by Invap and CNEA, along with 1,500 kgs of UO_2 in January 1986 for a research unit near Algiers. Algeria also has been negotiating with Argentina over a planned radioisotope production plant and other nuclear-related service work. It is unlikely that any decision by Algeria to buy the commercial PHWR will be taken before about 1990. It has been reported that CNEA personnel have been helping explore for uranium in Algeria.

Argentina also has actively pursued discussions with Albania, aimed at supplying that country with a 5-MWt research reactor and associated fuel supplies and other services. Thus far, no contracts are known to have been agreed on, and talks are continuing.

Conclusion

Although Argentina's reactor program includes only two operating reactors, with one unit under construction, the country has made great efforts to develop a complete fuel cycle capability, and could in the future become exporters of nuclear technology and services. Its relations with other nuclear-industry countries have been based on Argentina's philosophy of "nuclear independence," which has somewhat limited trade between Argentina and some other nations.

Argentina's uranium production capacity has fallen slightly below its reactor requirements in recent years, and further investment in production is likely to be needed if it is to continue to be self-sufficient in uranium. Any investment will probably be made at the Sierra Pintada orebody, near the currently-producing San Rafael mine and mill in Mendoza Province.

REACTORS ENTERING SERVICE IN 1987

Introduction

During 1987, 26 reactors entered commercial operation, in 10 countries, totaling approximately 26,500 MWe net capacity. Table 1 shows the additions, by country. In the USA, 7 reactors entered service, followed by the USSR and France, with 5 and 4 reactors, respectively.

It should be noted that differences in how "commercial operation" is defined, between different countries, or even states in the USA, makes it difficult to accurately state when a particular unit has entered service. In some cases, reactors may be connected to electricity grids for some time before being declared in commercial operation, while in other cases, a unit's status under Public Utility Commission or other regulatory structures might be the determining factor. The following presents a summary of the best information available to Nuexco at the beginning of 1988.

Bulgaria

Bulgaria's **Kozloduy Unit 5** (1,000 MWe) began operating in October 1987. This unit is the first of the new series VVER-1000 PWRs to be completed outside the USSR, and the entry of this reactor will raise Bulgaria's share of nuclear-generated electricity to about 40 percent of the total. The Kozloduy site already had 4 VVER-440 reactors in operation, and the sixth unit, a 1,000-MWe unit virtually identical to Unit 5 is in an advanced stage of construction and is scheduled to begin operating in 1988.

Canada

Ontario Hydro's **Bruce Unit 8**, a 837-MWe CANDU reactor, entered service in May 1987, slightly ahead of schedule. The entry of this unit into operation completes the reactor construction program at the Bruce site, which now has a total gross generating capacity of over 6,000 MWe. Until it was briefly shut down in August 1987 due to a heavy water leak, Bruce Unit 5 had operated continuously for 475 days.

Pickering Unit 1, which had been shut down since March 1984 for retubing, returned to service in October 1987. **Pickering Unit 2**, which also had been closed for retubing, is expected to re-enter service in May 1988. The retubing project on the two reactors was required after Unit 2 suffered a tube rupture, caused by hydride blisters forming in the zirconium pressure tubes. Pickering Units 1 and 2 were the only units in Canada whose pressure tubes were made of that material.

With the completion of Bruce Unit 8, Canada's remaining reactor construction program consists of Ontario Hydro's four Darlington reactors (all 880-MWe CANDUs), scheduled to begin operation in 1989 through 1992.

Czechoslovakia

Czechoslovakia's eighth reactor, **Dukovany Unit 4** (440-MWe PWR) began full operation in October 1987, after undergoing testing since April. All of the country's reactors are the Soviet VVER-440 model, and four additional units are under construction.

France

In France, four reactors entered commercial service in 1987, while four others were connected to the electricity grid but had not formally been declared commercial. **Chinon Unit B3**, the 33rd of the 870-MWe PWR series, began commercial operation in March, and **Cattenom Unit 1** (1,265-MWe) entered commercial service in April. **Flamanville Unit 2** (1,290-MWe) and **Saint Alban Unit 2** (1,300-MWe) also were declared in commercial operation in 1987. These four reactors are considered by Electricite de France (EdF) to have been 1986 connections, but there is a 9 to 12 month delay in achieving what the utility considers commercial operation.

In addition, **Chinon Unit B4** (870-MWe), **Cattenom Unit 2**, **Belleville Unit 1** and **Nogent Sur Seine Unit 1** (all 1,265-MWe PWRs) were connected to the grid in 1987. The startup of the Belleville reactor marked France's 50th commercial nuclear reactor coming into service. **Chinon Unit A3**, which had been out of operation for repairs since May 1984, began generating electricity in December. Currently, there are ten reactors under construction in France, scheduled to begin operating between 1988 and 1993. EdF has not announced any plans to order additional reactors in 1988.

Federal Republic of Germany

The 300-MWe **Thorium High-Temperature Reactor**

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Table 1

NUCLEAR UNITS ENTERING COMMERCIAL OPERATION DURING 1987[1]

Country/Unit	Utility or Owner	MWe (Net)	Type
Bulgaria			
Kozloduy 5	Electroenergetica	1,000	PWR
Canada			
Bruce 8	Ontario Hydro	837	PHWR
Czechoslovakia			
Dukovany 4	Fed. Ministry for Fuels and Energy	440	PWR
France			
Cattenom 1	Electricite de France	1,265	PWR
Chinon B3	Electricite de France	870	PWR
Flamanville 2	Electricite de France	1,290	PWR
Saint Alban 2	Electricite de France	1,300	PWR
Also connected to the grid in 1987:			
Belleville 1	Electricite de France	1,275	PWR
Cattenom 2	Electricite de France	1,265	PWR
Chinon B4	Electricite de France	870	PWR
Nogent-sur-Seine 1	Electricite de France	1,275	PWR
Subtotal		9,410	
Federal Republic of Germany			
Muelheim-Kaerlich	RWE	1,227	PWR
THTR-300	Hochtemperatur-Kernkraftwerk GmbH	300	HTGR
Subtotal		1,527	
Hungary			
Paks 4	Hungarian Electric Works	440	PWR
Japan			
Fukushima II-4	Tokyo Electric Power Co.	1,067	PWR
Hamaoka 3	Chubu Electric Power Co.	1,066	BWR
Tsuruga 2	Japan Atomic Power Co.	1,115	PWR
Subtotal		3,248	

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[1] Sources: IAEA, utility companies, and published sources.

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Table 1 (Cont.)

NUCLEAR UNITS ENTERING COMMERCIAL OPERATION DURING 1987

Country/Unit	Utility or Owner	MWe (Net)	Type
South Korea			
KNU 8 (Yongkwang 2)	Korea Electric Power Co.	900	PWR
USA			
Harris	Carolina Power and Light Co.	900	PWR
Vogtle 1	Georgia Power Co.	1,100	PWR
Braidwood 1	Commonwealth Edison Co.	1,120	PWR
Byron 2	Commonwealth Edison Co.	1,120	PWR
Perry 1	Cleveland Electric Illuminating Co.	1,205	BWR
Beaver Valley 2	Duquesne Light Co.	833	PWR
Clinton 1	Illinois Power Co.	933	BWR
Subtotal		7,211	
USSR			
Balakovo 2	Minpower	1,000	PWR
Ignalina 2	Minpower	1,500	RBMK
Kalinin 2	Minpower	1,000	PWR
Rovno 3	Minpower	1,000	PWR
Zaporozhye 3	Minpower	1,000	PWR
Subtotal		5,500	
TOTAL Net MWe		**30,513**	

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(THTR-300) in Hamm-Uentrop, owned by a consortium of utilities and other German companies, was formally accepted by its owners and began commercial operation in June 1987. The reactor had generated more then one billion kilowatt-hours since November 1985 during its testing period, prior to commercial operation. RWE's (Rheinisch-Westfaelisches Elektrizitaetswerk AG) **Muelheim-Kaerlich** plant (1,227-MWe PWR) also began commercial operation in mid-1987.

Hungary

Hungary's **Paks Unit 4** (440-MWe PWR) entered commercial operation at the end of October 1987, completing the reactor construction program at the Paks site, which now has four VVER-440 PWRs, supplied by the USSR, operating there. Construction of two VVER-1000 units is scheduled to begin in 1988.

Japan

Three reactors began operation in Japan in 1987. In February, Japan Atomic Power Company's (JAPC) **Tsuruga Unit 2** (1,115-MWe PWR) officially entered service. In August, Chubu Electric Power Company's **Hamaoka Unit 3** (1,066-MWe BWR) began operating. Tokyo Electric Power Company's (TEPCO) **Fukushima Unit II-4** (1,067-MWe PWR) was the last unit to enter commercial service in 1987, bringing Japan's nuclear capacity to 35 units, with a total nuclear generating capacity of 25,850 net MWe.

TEPCO placed orders for two additional units in 1987. The units are advanced 1,350-MWe BWRs jointly developed by General Electric Corp. and its licensees Hitachi Ltd. and Toshiba Corp.

South Korea

Korea Nuclear Unit 8 (KNU-8), a 900-MWe PWR, entered commercial service in June 1987. This unit is now called Yongkwang Unit 2. With this reactor's contribution, South Korea's seven nuclear plants constitute over 30 percent of the total electrical capacity. Korea Electric Power Company (KEPCO) placed one of the few orders for new nuclear plants in 1987. The company signed contracts in April for Units 3 and 4 at the Yongkwang site (also called KNU 11 and 12).

USA

Seven reactors entered commercial service in the USA in 1987, adding over 7,000 MWe of installed capacity to the US nuclear generating base (Table 1). By the end of the year, four other reactors had received full-power licenses, and one had received a low-power license, but none of those units entered commercial operation. This compares favorably to the progress made in 1985 and 1986, in which eight new units entered service in each year.

Commonwealth Edison Company's **Byron Unit 2** (1,120-MWe PWR) formally entered service in April 1987, almost two months ahead of schedule. The company's **Braidwood Unit 1** (1,120-MWe PWR) also began operating in April 1987, although it has not been formally declared to be in "commercial operation" under the Illinois Commerce Commission's (ICC) definition of the term. The ICC had earlier approved the plant's operation.

Also in April, Illinois Power Company's **Clinton Unit 1** (933-MWe General Electric BWR) was connected to the power grid, beginning power ascension and testing. The unit was actually placed in service in November, although, as in the case of Braidwood Unit 1, the ICC had not formally granted it commercial status.

Carolina Power & Light Company's **Shearon Harris Unit 1** (900-MWe Westinghouse PWR) was declared to be in commercial operation at the beginning of May 1987. The plant's construction cost reached $3.8 billion, and it is the only unit to be constructed at that site, after three other units initially planned for the site were canceled several years earlier.

Duquesne Light Company's **Beaver Valley Unit 2** (833-MWe PWR) entered service in November 1987, having the distinction of being the first US reactor to be granted a full power license without a direct public vote by the NRC commissioners, since the accident at Three Mile Island in 1978.

Cleveland Electric Illuminating Company's **Perry Unit 1** (1,205-MWe BWR) also entered service in November. The unit had been completed since January 1987, but the occurrence of an earthquake near the plant site caused an intervention in the NRC proceedings, delaying licensing until November.

Georgia Power Company's **Vogtle Unit 1** (1,100-MWe PWR) entered commercial operation at the end of May 1987. Construction of the unit began in 1974, and the total cost of the two-unit plant (Unit 2 is scheduled to begin

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operation in 1988) is nearly $9 billion.

The US nuclear backlog continues to shrink, and, excluding units that are either held up by regulatory or legal problems (such as Seabrook and Shoreham), or are considered indefinitely deferred, there are only seven reactors left under active construction that have not yet received at least fuel-loading licenses. Ten reactors remain either deferred or officially still on order.

USSR

Five reactors began operating in the USSR in 1987. **Ignalina Unit 2** (1,500-MWe RBMK) entered service in August, the only RBMK model reactor to do so in 1987. In addition, **Balakovo Unit 2, Kalinin Unit 2** , **Rovno Unit 3**, and **Zaporozhye Unit 3** (all VVER-1000 model 1,000-MWe PWRs) also were completed and began operating.

At present it appears that the USSR will not complete Chernobyl Units 5 and 6. The two units were deleted from the latest five-year plan.

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RECENT DEVELOPMENTS

USA

Changes in DOE's High-Level Waste Program

The search for an acceptable repository for high-level nuclear wastes in the USA may be nearing resolution, with the US Congress deciding on Yucca Mountain, Nevada as the probable site. In December 1987, members of key committees of the US House of Representatives and Senate agreed on a compromise package of amendments to the Nuclear Waste Policy Act (NWPA) that creates major changes in the US high-level waste disposal program, managed by DOE. President Reagan signed the bill on December 22, 1987.

The compromise, which is part of the FY1988 budget reconciliation bill, focuses DOE's efforts on the Yucca Mountain site, and directs DOE to cease site characterization work at the remaining two candidate sites — Hanford, Washington and Deaf Smith County, Texas. In the event that the Yucca Mountain site proves unsuitable, DOE is to cease work there and report its findings back to Congress.

The new legislation offers certain financial incentives for the state agreeing to accept the repository site (in this case, Nevada, should it accept) — the state will receive $10 million per year for accepting the facility, increasing to $20 million upon receipt of spent fuel. A unique provision offers "special consideration" to Nevada in competing for federal research projects if it agrees to accept the repository.

In addition, the bill authorizes construction of a Monitored Retrievable Storage (MRS) facility, but with conditions that make it impossible for an MRS to assume the role of a *de facto* waste repository. The MRS would store and package high-level nuclear waste before shipping it to a permanent repository. Authorization for construction of the MRS will only take place after the Nuclear Regulatory Commission (NRC) licenses the permanent repository, preventing the MRS from acting as a substitute for a permanent facility. Should construction at the permanent repository stop, or the facility lose its license, the MRS would lose its authorization. MRS capacity will be limited to 15,000 metric tons of spent fuel.

The bill outlines a plan to appoint a negotiator empowered to negotiate arrangements for both the permanent repository and the MRS sites, who will try to find a state willing to voluntarily accept the MRS. DOE's earlier decision to make Oak Ridge, Tennessee the MRS site is no longer effective — DOE must again begin its survey of acceptable sites, including the Oak Ridge site. A state will be eligible to recieve $5 million per year for agreeing to accept the MRS, increasing to $10 million per year when spent fuel is actually delivered there.

The compromise in Congress has created both antagonism and pessimism in Nevada. Some Nevada officials believe that the state has sufficient evidence to prove the site unsuitable, but fear that political pressure from Washington, D.C. will force DOE to arrive at a conclusion of suitability regardless of the "facts."

One of the most contentious issues involves interpretation of the Site Characterization, a massive effort to document the physical conditions of the repository, which is designed to provide the information for a determination of suitability or non-suitability. In January, DOE released a "consultation draft" of the Site Characterization Plan (SCP), summarizing the 7,000-plus pages of the actual document.

A prime concern of scientists is the rate of groundwater migration through the rocks at the site. Since at this site the water table is about 1,000 ft. (300 m) below the proposed level of the facility (about 1,200 ft., or 370 m), the rate of percolation of water downward through the dry rocks lying above the repository must be slow enough not to affect the radioactive materials being stored. The Site Charcterization will focus on obtaining the information to document (or estimate) any potential water flow or other problems.

Since the compromise legislation was announced, activists opposed to the NWPA repository, wherever it may be located, have had to re-assess their options for blocking it. It is unclear which, and how many, of the existing lawsuits aimed at stopping the project will be affected by the recent amendments to the NWPA, but many of those court challenges will be made moot by the Congressional action. It is also likely that new legal challenges will be mounted. With both the national environmentalist opposition and many Nevada legislators now able to focus their resources on blocking approval of only one site, intense opposition may be anticipated.

Narrowing the site selection process to Yucca Mountain already has led to economic slowdowns at the Hanford and Texas sites, where the site characterization phases had resulted in major economic windfalls in those areas. The area surrounding the Deaf Smith County, Texas site, particularly, had been in a recession, and the multi-year, several-billion dollar preliminary site analysis had provided hope for some renewed employment and a boost to the local

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economy. DOE is in the process of closing down its operations at both of the now-unnecessary sites.

The recent amendments to the NWPA appear, at least for now, to have resolved the impasse in the attempt to find a solution to the nation's high-level nuclear waste accumulation, expected to exceed 40,000 tonnes of spent fuel by the year 2000. Whether the Nevada site will prove suitable, and whether legal challenges to the program can stall its progress and final implementation, will take considerable time to resolve. Although uncertainties remain, Congress has taken a significant step forward in nuclear waste policy.

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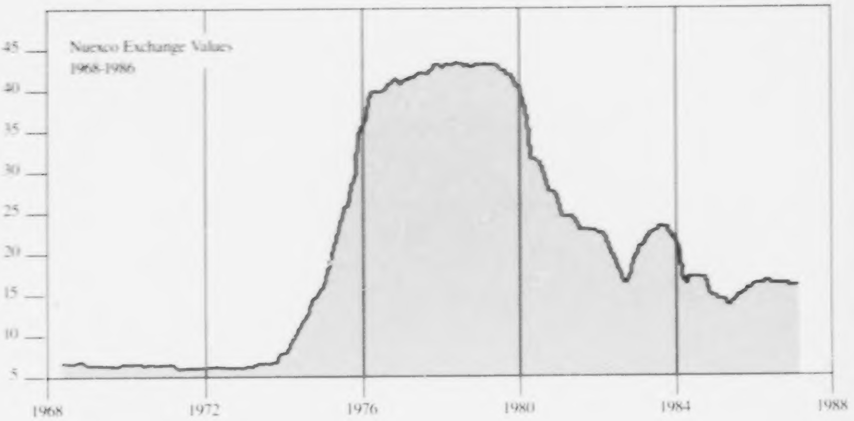
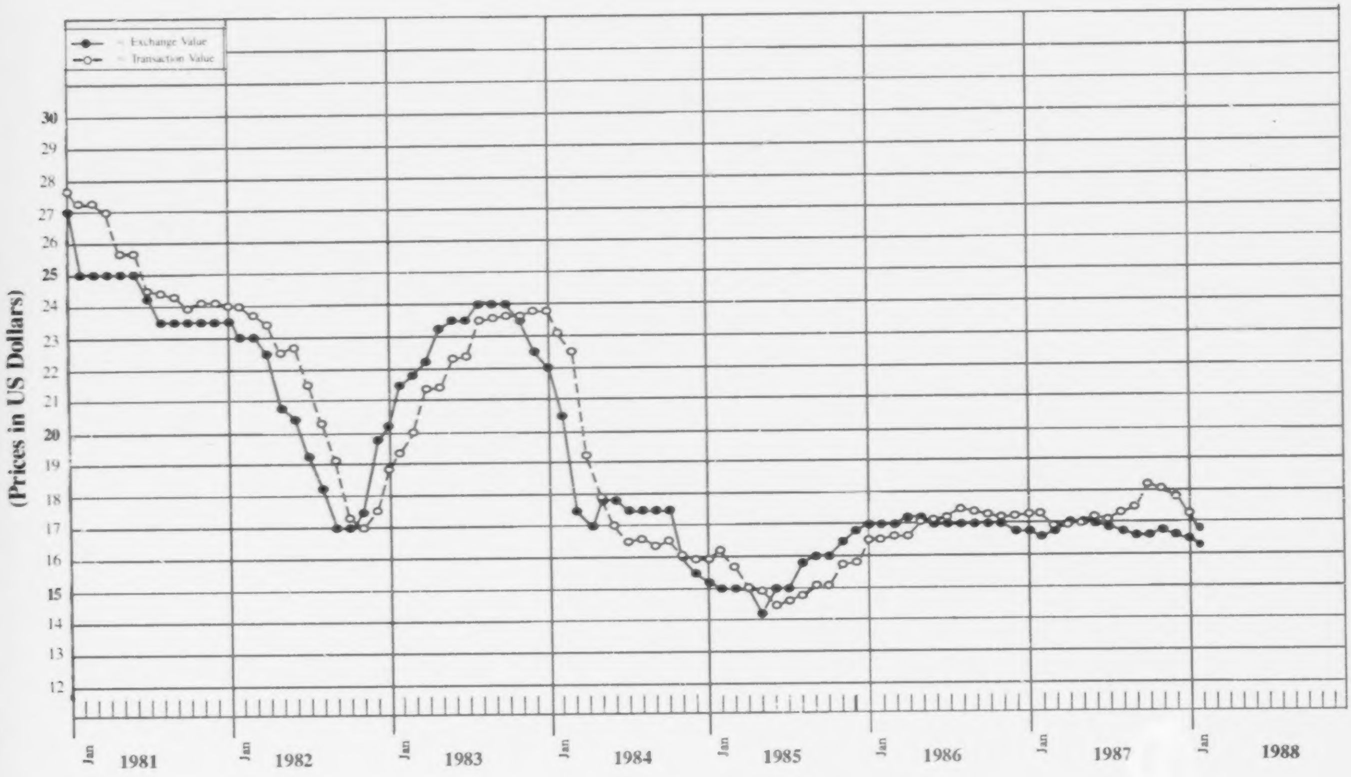
HISTORICAL MARKET DATA





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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969		6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	**16.30**											

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	**0.70**											

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	**16.85**											

HISTORICAL MARKET DATA

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	**1.90**											

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated (US Dollars/kg. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	**46.50**											

HISTORICAL US UF_6 PREMIUM (Relative to the UF_6 Value)

Determined as of the last day of the month indicated (US Dollars/kg. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	**1.25**											

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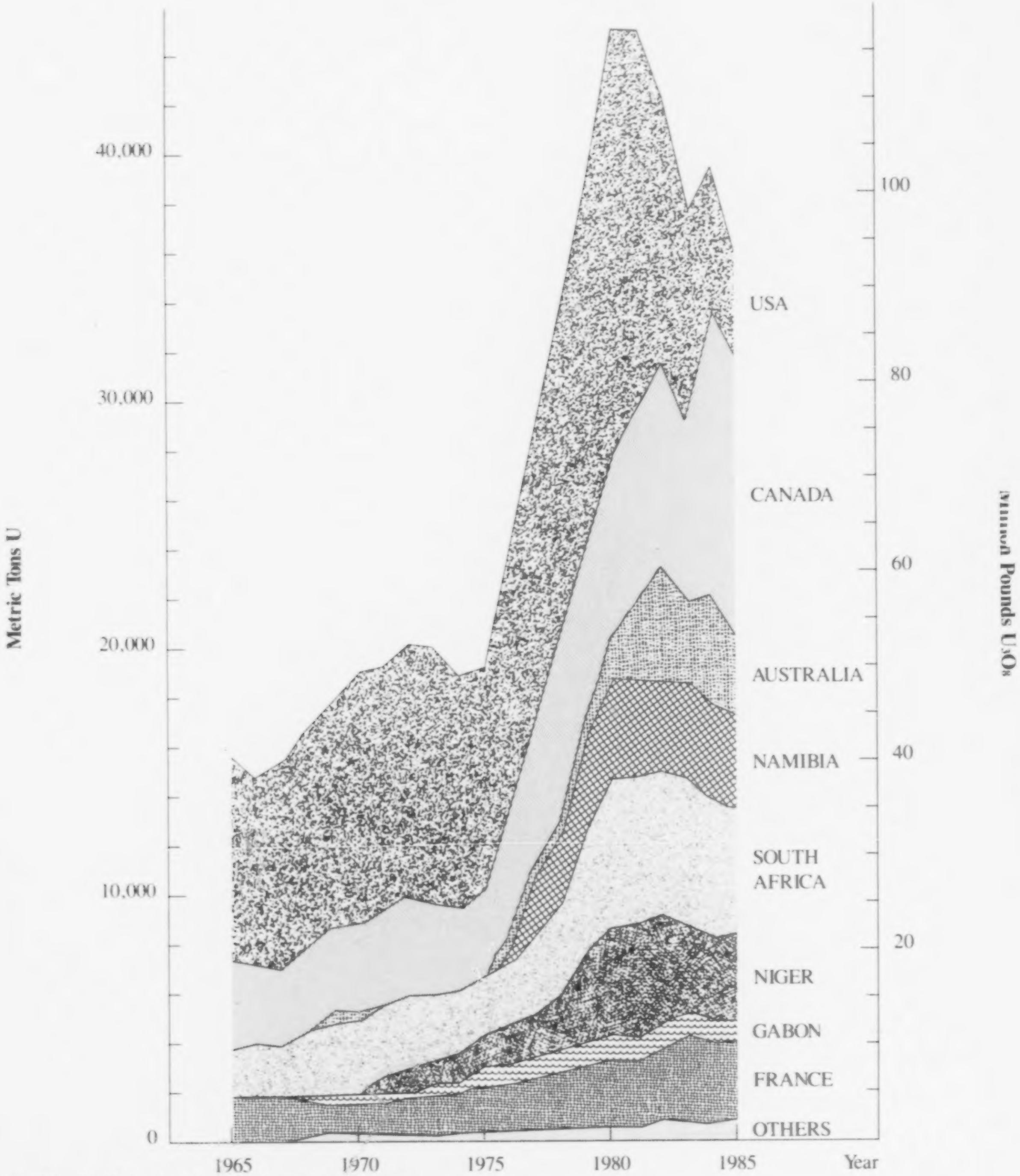
HISTORICAL WOCA[1] URANIUM PRODUCTION[2]
(Compiled by OECD/IAEA Joint Report[3])



[1] WOCA = World Outside of Centrally-planned Economic Areas.

[2] 1985 production data are preliminary.

[3] A joint report issued biennially by the OECD Nuclear Energy Agency and the International Atomic Energy Agency.

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HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	202.7
1986	Avg.	155.5	101.5	213.0
Jan	1987	—	106.2	215.9
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2
Apr	1987	—	108.3	222.2
May	1987	—	108.1	222.0
June	1987	167.2	108.1	221.8
July	1987	—	108.7	221.1
Aug	1987	—	110.5	222.3
Sep	1987	170.0	109.3	223.1

P = Preliminary R = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

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CANADA

				Wage-earner Data: Average Hourly Earnings (C$)[2]				
		Industrial Products Price Index: All Commodities[1] (1981 = 100)	**Consumer Price Index: All Items (1981 = 100)**	**Uranium Mines (SIC 057)**	**Metal Mines (SIC 051-059)**	**Mines, Quarries and Oil Wells[3] (SIC 051-099)**	**Metal Rolling, Casting and Extruding (SIC 298)**	**Chemicals and Chemical Products Industries (SIC 372-379)**
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.1	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.7	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.0	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.3	139.8	20.06	17.31R	16.33R	13.01R	13.37R
Nov	1987	125.0	140.4	20.47P	17.45P	16.46P	12.45P	13.41P
Dec	1987	124.9	140.5	—	—	—	—	—

P = Preliminary   R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.[7]	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.88	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
1985	Avg.	68.76	151.6	192.6	181.2	726,804	396,956
1986	Avg.	80.18	177.9	228.5	216.6	757,218	480,956
Jan	1987	—	—	248.3	233.9	740,031	532,577
Feb	1987	—	—	251.0	237.0	757,872	598,986
Mar	1987	88.17	197.1	255.0	239.6	762,697	536,006
Apr	1987	—	—	258.2	242.5	761,850	533,487
May	1987	—	—	261.2	243.6	759,421R	530,981
Jun	1987	90.74	203.5	263.1	244.9	759,433	573,546
July	1987	—	—	266.2	246.8	681,409	566,232
Aug	1987	—	—	270.0	249.9	—	—
Sep	1987	100.79	224.7	273.4	252.4	—	—
Oct	1987	—	—	276.5	255.5	—	—
Nov	1987	—	—	144.8[10]	—	—	—

P = Preliminary R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria: "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

[10] New base for November. To convert to old base, multiply CPI by 1.926.

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UNITED STATES

		Producer Price Index[1]				Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	274.8	268.8	246.8	85.7	10.26	10.63	8.30	6.94
1981	Avg.	304.1	293.4	272.4	94.0	11.55	11.98	9.12	7.62
1982	Avg.	312.3	299.3	289.1	100.0	12.31	12.93	9.96	8.21
1983	Avg.	315.7	303.1	298.4	103.9	12.58	13.43	10.58	8.67
1984	Avg.	322.6	310.3	311.1	107.7	13.05	13.43	11.07	9.04
1985	Avg.	323.8	308.7	322.2	111.2	13.38	13.74	11.56	9.46
1986	Avg.	312.2	299.8	328.4	114.1	13.20	13.49	11.98	9.65
Jan	1987	313.5	300.9	333.1	—	12.94	12.98	12.18	9.84
Feb	1987	314.9	302.2	334.4	—	12.99	12.83	12.21	9.84
Mar	1987	315.7	302.7	335.9	116.1	13.04	12.79	12.24	9.84
Apr	1987	317.3	305.0	337.7	—	13.16	12.90	12.30	9.82
May	1987	318.3	307.1	338.7	—	12.97	12.92	12.31	9.83
Jun	1987	319.9	308.2	340.1	117.2	13.05	12.93	12.27	9.84
Jul	1987	322.1	309.8	340.8	—	13.06	13.07	12.37	9.89
Aug	1987	323.8	310.6R	342.7	—	13.03	13.07	12.34	9.90
Sep	1987	323.3	310.4	344.4	117.8	13.19	13.44	12.56	9.98
Oct	1987	324.9	311.4	345.3	—	12.96R	13.06R	12.52R	9.95R
Nov	1987	325.4	311.9	345.8	—	12.89P	13.11P	12.58P	10.01P
Dec	1987	325.3	311.7	345.7	118.7	—	—	12.61P	10.09P

P = Preliminary R = Revised since last month

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[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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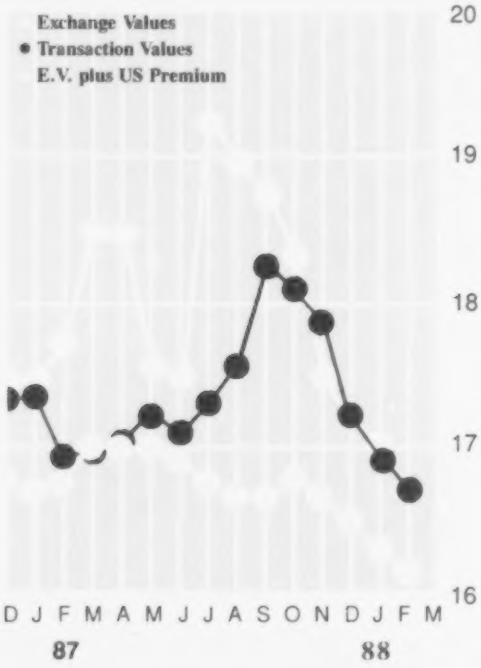

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EXECUTIVE SUMMARY
REPORT 235
(All data as of February 29, 1988)

Exchange Value
$16.15, down $0.15

The **Exchange Value** is **$16.15** per pound U_3O_8, down $0.15 since last month. The US Premium (relative to the Exchange Value) is $0.50, down $0.20 since last month.

UF_6 Value
$46.00, down $0.50

The **UF_6 Value** is **$46.00** per kg U as UF_6, down $0.50 since last month. The US Premium (relative to the UF_6 Value) is $1.25, unchanged since last month.

Transactions

Four recent natural uranium sales are reported, involving **less than 500,000** pounds equivalent U_3O_8. All of the sales involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **6.6 million** pounds U_3O_8 equivalent, up 700,000 pounds since last month. Active spot and near-term **uranium demand** totals **2.5 million** pounds, up 870,000 pounds from last month. The spot and near-term **supply-demand ratio** decreased to **2.7 to 1**.

Transaction Value
$16.65, down $0.20

The **Transaction Value** is **$16.65** per pound U_3O_8, **down $0.20** since last month. The calculation includes 18 transactions involving a total of 2.4 million pounds U_3O_8 and equivalent UF_6 and covers a period of 3 months.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged. One loan transaction is reported.

Conversion Value
$1.80, down 0.10

The **Conversion Value** is **$1.80** per pound U as UF_6, down $0.10 since last month. Active secondary market supply for conversion services for delivery within three years totals 150,000 pounds U as UF_6. Active demand totals 915,000 pounds U as UF_6. One secondary market conversion transaction is reported.

SWU Value $73,
unchanged

The **SWU Value** at .3% tails assay is **$73** per SWU, unchanged since last month. No secondary market SWU transactions are reported.

* * *

Basic Considerations

Numerous commercial and political factors affect transactions of natural uranium concentrates. Part one of this series examines some of these factors as they affect the part of the fuel cycle from mining through delivery at a conversion facility.

Raw Materials

Overall, 1987 uranium production fell about 2.5 percent from the previous year, to approximately 94.9 million pounds U_3O_8. Of the four leading uranium-producing nations, Australia, South Africa and the USA registered drops in output, while Canada, the leading producer, increased production in 1987.

Canada

The Canadian government has announced its intent to carry through a merger of Eldorado Resources and the Saskatchewan Mining Development Corportion (SMDC), by mid-1988. The proposed merger would create the world's largest uranium producing company.

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NUEXCO REPORT 235 FIGURES OF THE MONTH (February 29, 1988)	This Month (Report 235)	Last Month (Report 234)	12 Months Ago (Report 223)
Exchange Value (\$US per pound U_3O_8)	16.15	16.30	16.75
US Premium for the Exchange Value (\$US per pound U_3O_8)	0.50	0.70	1.00
UF_6 Value (\$US per kg U as UF_6)	46.00	46.50	48.00
US Premium for the UF_6 Value (\$US per kg U as UF_6)	1.25	1.25	2.50
Transaction Value (\$US per pound U_3O_8 equivalent)	16.65	16.85	16.90
Loan Rate (Per Annum)	3.5%	3.5%	3%
Conversion Value (\$US per pound U as UF_6)	1.80	1.90	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	6.6	5.9	3.4
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	2.5	1.6	2.3
Near-Term Supply-Demand Ratio	2.7	3.6	1.5
Recent Uranium Sales:[3]			
Number of Transactions	4	8	9
Quantity of Material (Millions of pounds U_3O_8 equivalent)	0.4	8.0	2.1
Nuexco SWU Value: (\$US per SWU)			
at 0.3 tails assay	73	73	80
US DOE SWU Prices: (\$US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6 [8]: (\$US per kgU as UF_6)			
2.5 w/o U_{235}	433	436	459
3.0 w/o U_{235}	553	557	586
3.5 w/o U_{235}	676	681	719
4.0 w/o U_{235}	801	806	852

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[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

March 1988 No. 235

R. GENE CLARK, *EDITOR* CHARLES B. LEWIS, *ASSISTANT EDITOR*

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February 29, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$16.15**/lb. U_3O_8	6,640[2]	2,500[2]
US Premium	**$0.50**		
UF_6 VALUE	**$46.00**/kg U as UF_6	6,640[2]	2,500[2]
US Premium	**$1.25**		
CONVERSION VALUE	**$1.80**/lb. U as UF_6	150	915
SWU VALUE **0.3 tails assay:**	**$73**/SWU	205	220
LOAN RATE	**3.5%**/annum	8,050	0

TRANSACTION VALUE

$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
16.65	**2.4**	**18**	**3**

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[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

[2] For either uranium concentrates or uranium hexafluoride.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed awillingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of February 29, 1988)

The **Exchange Value** is **\$16.15** per pound U_3O_8, down \$0.15 since last month. US-origin uranium is commanding a **premium** (relative to the Exchange Value) of **\$0.50** per pound U_3O_8 (down \$0.20) in the form of concentrates, and **\$1.25** per kilogram U (unchanged) in the form of UF_6.

Active supply of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **6,640,000** pounds U_3O_8 equivalent, up 700,000 pounds since last month. The corresponding figure for **active demand** is **2,500,000** pounds, up 870,000 pounds. The spot and near-term supply-demand ratio is to 2.7, down from 3.6 at the end of January.

The *Current Market Data* section of this Report lists four natural uranium sales, totaling approximately 400,000 pounds U_3O_8 equivalent.

The **Transaction Value** is **\$16.65** per pound U_3O_8, down \$0.20 since last month. The calculation extends over a 3-month period and includes 18 transactions involving 2.4 million pounds equivalent U_3O_8.

The **UF_6 Value** is **\$46.00** per kilogram U in UF_6, down \$0.50 since last month. Three transactions involving UF_6 are reported, totaling less than 400,000 pounds equivalent U_3O_8.

The **Conversion Value** is **\$1.80** per pound U as UF_6, down \$0.10 since last month. Active supply of secondary market conversion services totals 150,000 pounds U as UF_6. Active demand totals 915,000 pounds U as UF_6. One secondary market conversion transaction is reported.

The **Loan Rate** is **3.5 percent** per annum, unchanged since last month. One loan transaction is reported.

* * *

The **Exchange Value** declined \$0.15, to \$16.15 per pound U_3O_8 during February. The market for natural uranium concentrates was relatively inactive in February with only one transaction involving concentrates reported, for less than 100,000 pounds. One large transaction also was near conclusion at the end of the month. Demand for concentrates has increased since last month, but consists mainly of US utilities evaluating discretionary purchases. In addition, at least three potential US buyers have indicated that they might purchase non-US-origin material for 1988 delivery, and in some cases might consider natural UF_6 instead of concentrates. Given the discretionary nature of this demand, some sellers have further discounted their material in hopes of making a sale, contributing to the downward pressure on the Exchange Value. Buyers seeking smaller quantities of material appear to have the best chance of obtaining the lowest prices in the current market.

The **Premium** (relative to the Exchange Value) for US-origin concentrates declined \$0.20 to \$0.50 during February. The market for US-origin concentrates was almost totally inactive, and no transactions are reported. At the beginning of the month, producers were unwilling to offer below the \$17.00 per pound level for US origin, and potential buyers, who saw a general softening of the market and a reduction in the risk of import restrictions, were unwilling to pay the prices demanded by the producers. Although some producers later began lowering prices, even those lower price levels could not stimulate significant buyer interest.

Currently there is little demand for this material — only one US utility has specified domestic-origin, for a small quantity. US utilities still are waiting for the results of the US Producer vs. DOE lawsuit and the US-Canada Free Trade Agreement before committing to further major purchases. Most US utilities are preserving their inventories of US-origin and feeding non-US-origin material for enrichment, so as to allow maximum flexibility in the event that restrictions on use or import of non-US-origin uranium are imposed. While there was no buying activity in February in the market for US-origin material, it is likely that the reduced prices for this material could stimulate some demand in the near future.

The timetable for resolution of the US Producers vs. DOE lawsuit remains in doubt, although its position on the spring Supreme Court calendar could be finalized in early March. As of press time, no schedule had been released indicating the dates for oral arguments. If the case is placed on the calendar for hearing in April or May, it is likely that a ruling will be made by June 1988. However, if the case is postponed until the fall session, no decision should be expected before early 1989.

The status of the US-Canada Free Trade Agreement (FTA) also remains uncertain. While the Canadian Parliament's support for implementation is relatively strong, the passage of implementing legislation in the USA is questionable. The Reagan administration continues to support the Agreement, but the presence of the omnibus Trade Bill, budget concerns, and other situations have

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diverted attention away from the FTA. The Reagan Administration has reached agreement with the US House of Representatives on timely *procedural* consideration (that is, a timely vote), but this does not guarantee that the House will vote in favor of the FTA. Because of the nature of procedural rules in the US Senate, it is not possible to assure the same timely treatment by the Senate. It appears that the longer the FTA sits before Congress without ratification, the less likely are the prospects for its implementation. It now seems likely that if the FTA is implemented at all, it will be in late 1988 (after the November elections) or early 1989.

The **UF_6 Value** declined $0.50 to $46.00 per kgU as UF_6 during February. Three UF_6 transactions are reported, totaling less than 400,000 pounds equivalent U_3O_8 of non-US-origin material. At the end of February, two US utilities were in the market for substantial quantities of UF_6, one of which was seeking enriched uranium, although neither had specified US-origin. In addition, two entities in the Far East had expressed interest in purchasing enriched UF_6. Active supply of UF_6 remains relatively weak, compared to the market for concentrates.

The **Premium** (relative to the UF_6 Value) for US-origin UF_6 is unchanged at $1.25 per kg U as UF_6. Relatively little US-origin UF_6 is available for sale, but demand also is weak, and no transactions are reported. The low levels of US-origin UF_6 available in the spot market have contributed to greater price volatility, with prices varying depending on the size of demand. While small quantities of material might be available at prices below the UF_6 Value, larger lots are likely to strain the available supply and could lead to somewhat higher prices.

* * *

The **Loan Rate** is unchanged this month at 3.5 percent per annum. The supply of material available for loans remains large, but little or no firm demand exists at the present time. One short-term loan transaction, involving less than 300,000 pounds of natural uranium concentrates, is reported this month.

* * *

The **Conversion Value** declined this month to $1.80 per pound U as UF_6, as recent sales are indicating a softening of this market. Two European utilities and one US utility currently are evaluating offers for secondary market conversion, but this demand is largely discretionary. One secondary market transaction involving conversion is reported, at a cash price below this month's Conversion Value, but other factors in the transaction would cause the evaluated price to be close to the Conversion Value; it is notable in that extended payment terms and other conditions are now appearing in secondary market conversion transactions. Prices for conversion in Europe remain significantly higher than in the USA.

ENRICHED URANIUM AND SWU

The **SWU Value** is $73 per SWU, unchanged since last month, and no SWU transactions are reported. A wide range of SWU prices can be found, based on quantity, origin, location, and various risk factors. Three utilities currently are in the market for SWU. One US customer is expected to buy a significant quantity within the next two months, while two others in the Far East are interested in small quantities. For demand involving larger quantities, competition among sellers is likely to add downward pressure to prices; however, for small quantities of SWU, somewhat higher prices are likely, a situation quite the opposite of the markets for concentrates and UF_6.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (Feb 29, 1988)	Last Month (Jan 31, 1988)	12 Months Ago (Feb 28, 1987)	This Month (Feb 29, 1988)	Last Month (Jan 31, 1988)	12 Months Ago (Feb 28, 1987)
Australia (dollar)	22.45	22.83	24.83	58.35	59.35	64.54
Belgium (comm. franc)	570.07	567.55	632.08	1,482	1,476	1,643
Canada (dollar)	20.40	20.81	22.32	53.03	54.09	58.01
EEC (ecu)	13.20	13.16	14.79	34.33	34.22	38.46
Finland (markka)	65.95	66.07	75.86	171.44	171.77	197.22
France (franc)	92.29	91.52	101.70	239.92	237.94	264.40
FRG (mark)	27.26	27.17	30.55	70.87	70.63	79.43
Italy (lira)	20,092	19,983	21,691	52,235	51,951	56,392
Japan (yen)	2,073	2,070	2,564	5,389	5,382	6,666
Netherlands (guilder)	30.60	30.50	34.52	79.56	79.28	89.75
South Africa (rand)	33.51	32.21	34.54	87.11	83.75	89.79
Spain (peseta)	1,841	1,843	2,145	4,786	4,790	5,576
Sweden (krona)	96.65	97.78	107.93	251.26	254.21	280.58
Switzerland (franc)	22.42	22.10	25.73	58.30	57.44	66.89
UK (pound)	9.11	9.15	10.87	23.68	23.78	28.25
US (dollar)	16.15	16.30	16.75	41.99	42.38	43.55

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (Feb 29, 1988)	Last Month (Jan 31, 1988)	12 Months Ago (Feb 28, 1987)	This Month (Feb 29, 1988)	Last Month (Jan 31, 1988)	12 Months Ago (Feb 28, 1987)
Australia (dollar)	23.14	23.60	25.05	60.16	61.35	65.12
Belgium (comm. franc)	587.72	586.70	637.74	1,528	1,525	1,658
Canada (dollar)	21.03	21.51	22.52	54.67	55.92	58.53
EEC (ecu)	13.61	13.61	14.93	35.39	35.38	38.80
Finland (markka)	67.99	68.30	76.54	176.75	177.57	198.99
France (franc)	95.14	94.61	102.61	247.35	245.96	266.77
FRG (mark)	28.11	28.08	30.83	73.07	73.01	80.15
Italy (lira)	20,714	20,657	21,886	53,852	53,704	56,897
Japan (yen)	2,137	2,140	2,587	5,556	5,56	6,725
Netherlands (guilder)	31.55	31.52	34.83	82.03	81.96	90.55
South Africa (rand)	34.54	33.30	34.85	89.81	86.57	90.59
Spain (peseta)	1,898	1,905	2,164	4,935	4,952	5,626
Sweden (krona)	99.64	101.08	108.89	259.04	262.78	283.09
Switzerland (franc)	23.12	22.84	25.96	60.10	59.38	67.49
UK (pound)	9.39	9.45	10.96	24.41	24.58	28.50
US (dollar)	16.65	16.85	16.90	43.29	43.81	43.94

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb U as UF_6			per kg U as UF_6		
Country (currency)	**This Month (Feb 29, 1988)**	**Last Month (Jan 31, 1988)**	**12 Months Ago (Feb 28, 1987)**	**This Month (Feb 29, 1988)**	**Last Month (Jan 31, 1988)**	**12 Months Ago (Feb 28, 1987)**
Australia (dollar)	2.50	2.66	2.67	5.52	5.87	5.88
Belgium (comm franc)	63.54	66.16	67.92	140.07	145.85	149.75
Canada (dollar)	2.27	2.43	2.40	5.01	5.35	5.29
EEC (ecu)	1.47	1.53	1.59	3.24	3.38	3.50
Finland (markka)	7.35	7.70	8.15	16.20	16.98	17.97
France (franc)	10.29	10.67	10.93	22.68	23.52	24.09
FRG (mark)	3.04	3.17	3.28	6.70	6.98	7.24
Italy (lira)	2,239	2,329	2,331	4,937	5,135	5,139
Japan (yen)	231.04	241.30	275.52	509.35	531.98	607.43
Netherlands (guilder)	3.41	3.55	3.71	7.52	7.84	8.18
South Africa (rand)	3.73	3.75	3.71	8.23	8.28	8.18
Spain (peseta)	205.20	214.79	230.50	452.38	473.52	508.17
Sweden (krona)	10.77	11.40	11.60	23.75	25.13	25.57
Switzerland (franc)	2.50	2.58	2.76	5.51	5.68	6.10
UK (pound)	1.02	1.07	1.17	2.24	2.35	2.57
US (dollar)	1.80	1.90	1.80	3.97	4.19	3.97

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value at 0.30% tails assay (Feb 29, 1988)**	**UF_6 Value per kg U as UF_6 This Month (Feb 29, 1988)**	**UF_6 Value per kg U as UF_6 Last Month (Jan 31, 1988)**
Australia (dollar)	101.46	63.93	65.12
Belgium (comm. franc)	2,577	1,624	1,619
Canada (dollar)	92.19	58.09	59.35
EEC (ecu)	59.69	37.61	37.55
Finland (markka)	298.08	187.83	188.48
France (franc)	417.14	262.85	261.08
FRG (mark)	123.23	77.65	77.50
Italy (lira)	90,819	57,228	57,006
Japan (yen)	9,370	5,904	5,906
Netherlands (guilder)	138.34	87.17	86.99
South Africa (rand)	151.45	95.43	91.89
Spain (peseta)	8,322	5,244	5,257
Sweden (krona)	436.86	275.28	278.94
Switzerland (franc)	101.36	63.87	63.03
UK (pound)	41.17	25.94	26.09
US (dollar)	73.00	46.00	46.50

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4258	1988	50-100	98-102	Intermediary	Utility	
4259	1988	101-300	98-102	Producer	Utility	UF_6
4263	1988	101-300	98-102	Intermediary	Intermediary	UF_6
4264	1988	50-100	98-102	Intermediary	Utility	UF_6

Loan Transactions

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Loan Rate	Lender	Borrower	Remarks
4262	1988	101-300	R[3]	R[3]	Intermediary	

Conversion Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks
4265	1988	101-300	82-87	Intermediary	Utility	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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URANIUM SUPPLY
(February 29, 1988)

Delivery Period[1]
(Thousands of Pounds U_3O_8)

Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1002	270	—	
87-1005	200	400 per year	1988-95
87-1023*	800	500 per year	1988-90
87-1061	200	200 per year	U_3O_8 or UF_6, 1988 on
87-1123	400	—	
87-1130*	500	—	
87-1141	500	200 per year	1989-92
87-1152	200	—	
87-1156	825	—	
87-1159*	60	—	
87-1161	1,000	1,000 per year	
88-1000*	260	—	U_3O_8 or UF_6
88-1001	200	—	1988
88-1026	300	—	1988
88-1033A*	50	—	1988, UF_6
88-1036*	100	—	1988
88-1041*	775	—	UF_6
87-1001	—	400 per year	1989 on
TOTAL:	6,640		
INACTIVE			
87-1017	1,000	—	
87-1053	100	400 per year	1989 on
87-1135	500	—	UF_6
87-1019	—	600 per year	1988-91
TOTAL:	1,600		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: None.

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CURRENT MARKET DATA

URANIUM DEMAND
(February 29, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
87-1040*	700	300	1989, UF_6
87-1121	650	650 per year	1988-96
87-1146*	25	—	
88-1013A*	150	—	1988, UF_{6e}
88-1017A*	750	—	1988, UF_{6e}
88-1024*	50	—	1988
88-1035A*	40	—	1988, UF_{6e}
88-1015	135	—	1988
87-1013	—	1,200 per year	1990-95
87-1021	—	200 per year	1992 on
87-1108	—	200 per year	1991-2000
87-1134	—	260	1989
87-1172	—	500 per year	1990 on
88-1044*	—	2,400	1991-95
TOTAL:	2,500		
INACTIVE			
87-1154A*	80	—	1988, UF_{6e}
87-1163	160	—	1989-92
88-1014	190	—	1988
87-1166*	—	650	1989, UF_6
88-1022	—	225	1989, UF_6
TOTAL:	430		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1040, 87-1114, 87-1122, 87-1125, 87-1150, 87-1158, 88-1011.

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LOAN SUPPLY AND DEMAND
(February 29, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1012	2,000	—	
87-1064	600	—	
87-1071	1,000	—	UF_6
87-1157	4,000	—	
87-1167	450	—	
TOTAL:	8,050		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
TOTAL:	2,000		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 87-1119.

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CONVERSION SUPPLY AND DEMAND
(February 29, 1988)

	Delivery Period[1] (Thousands of Pounds U as UF_6)		
Nuexco Project Number	**Within 3 Years**	**Beyond 3 Years**	**Remarks**
Available for Sale:			
ACTIVE			
88-1004	150	—	
TOTAL:	150	750	
INACTIVE			
87-1008	750	750	
TOTAL:	750		
Inquiries to Purchase:			
ACTIVE			
88-1020	100	—	
88-1021	65	—	
88-1034*	750	—	
TOTAL:	915		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 87-1000C.

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SWU SUPPLY AND DEMAND
(February 29, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Delivery Period[1] (Thousands of SWU) Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1058	90	—	1988
87-1068	100	—	1988
88-1033B*	15	—	1988
TOTAL:	205		
INACTIVE			
87-1004	55	—	1988
87-1128	300	—	1988
TOTAL:	355		
Inquiries to Purchase:			
ACTIVE			
88-1017B	160	—	1988, UF$_6$e
88-1013B*	40	—	1988,UF$_6$e
88-1035B*	20	—	1988, UF$_6$e
TOTAL:	220		
INACTIVE			
87-1065	150	—	1988
87-1154B*	20	—	1988, UF$_6$e
87-1171	130	—	1988
TOTAL:	300		

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*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1162.

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COMMERCIAL CONSIDERATIONS IN URANIUM TRANSACTIONS — PART 1

Introduction

In the nuclear fuel cycle, uranium appears in a variety of forms including: ore, natural uranium concentrates, natural UF_6, enriched and depleted UF_6, enriched UO_2 powder, pellets, fabricated fuel, and spent fuel. Less common forms include UF_4 (green salt), natural UO_2, and uranium metal. Most uranium commerce, however, involves one or more of the following forms — natural uranium concentrates (referred to herein as "concentrates"), natural UF_6, and enriched UF_6.

While uranium is normally considered fungible, uranium commerce is often circumscribed by such factors as:

1. Milling arrangements;
2. converters' policies and capabilities;
3. storage arrangements;
4. origin restrictions; and,
5. ownership, possession and location considerations.

This article reviews these factors and the resulting commercial implications associated with natural uranium concentrates. Future articles will cover natural UF_6 and enriched UF_6.

Natural Uranium Concentrates (U_3O_8)

Uranium is recovered from uranium ores extracted from underground and open pit mines and from uranium-bearing solutions, including in-situ, mine-water or by-product operations. The ores are processed in mills, resulting in a variety of concentrate forms* These are commonly measured in U_3O_8 equivalents. While uranium production operations normally produce concentrates for immediate delivery to customers to fulfill contractual commitments, some operations produce at rates in excess of near-term delivery commitments. The usual reasons for such excess production include:

1. Obtaining the economic benefits of levelized or higher production rates;
2. having extra material available for sale on the spot market;
3. processing pre-production or pilot plant ores from mine development activities, and;
4. processing ore stockpiles in batches and cleaning up in connection with temporary or permanent shutdown of production.

Other, less common reasons could include the desire to earn a return on a sunken investment and to postpone the required reclamation (by continuing operations to maintain current licenses).

As a rule, almost all uranium is produced as a dry, powdery concentrate, ranging in color from bright yellow (hence the term "yellowcake") to greenish-black, and is shipped in 55 gallon drums. A drum holds about 1,000 pounds of concentrates, containing somewhere between 650 and 900 pounds of U_3O_8 equivalent (most often 750 to 800 pounds). The principal exception to this general rule is uranium that is delivered to conversion plants in slurry form (usually because the producer lacks a drying facility). A "commercial lot" of uranium is not a precise quantity, but, based on the typical capacity of one truck, the minimum lot size is about 40 drums, containing about 30,000 to 32,000 pounds of U_3O_8.

The concentrates located at a particular mill site may be owned by any of a number of different entities. In the simplest case, both the mine which produces the ore and the mill that processes it are owned by the same entity, and the concentrates produced by the mill are owned by that entity.

In the case of toll milling, the owner of the ore pays a fee (a tolling charge) to the mill for processing the ore into concentrates. The owner of the ore (the tolling customer), not the mill owner, is the owner of the resulting concentrates, subject to whatever other arrangements may exist with respect to the storage and transport of such material. It should be noted that in some cases the mill owner may collect the tolling charge in kind, as a percentage of the concentrates produced. In the case of custom milling, the mill owner buys the ore (from miners or other parties) for cash or other considerations, and owns the concentrates produced.

There are a number of variations on this theme, for some mills may provide both toll and custom milling services in addition to processing ore provided by the mill owner. In

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* The natural uranium concentrates currently being produced are as likely to be in the form of $Na_2U_2O_7$ (sodium diuranate), $(NH_4)_2U_2O_7$ (ammonium diuranate), UO_2, or UO_3 as they are to be in the form of U_3O_8. That equivalent pounds of U_3O_8 are the accepted units of commerce and pricing is an accident of history, resulting from the fact that the earliest uranium mining involved ores and recovery processes that produced concentrates in that form. The term "concentrates" is used in this article, in lieu of the more precise phrase, "natural uranium concentrates."

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other cases the mill owner and the mill operator may be different entities, and it is possible that neither, both or only one actually mines uranium. Ownership of the concentrates produced at such mills, and the right to take or sell such concentrates, is governed by the specific contractual arrangements among the various parties. These arrangements naturally result in commingling of concentrates from different mines, but custom dictates that the mill output be attributed to individual mines in proportion to the equivalent amount of uranium content of the ore, as mill feed, which came from those mines. In any case, the product must reflect the characteristics of the feed, and the amount of uranium of any origin must not be increased or decreased.

In addition there are occasions when a utility or other buyer pays for and/or takes title to concentrates located at the mill site. Such arrangements take two forms. The first, which might be termed the "cordon-off" approach, involves identifying and physically segregating certain drums of concentrates as belonging to the buyer. Since the concentrates have not been weighed, sampled and assayed at a conversion facility, such an arrangement must include provisions relating to final settlement between buyer and seller if, upon eventual delivery to a converter, the quantity is found to be different from that purchased, or if surcharges are applicable or rejection occurs. The cordon-off approach prevents commingling and protects the owner from certain claims on material that has been subject to commingling.

The second approach involves an agreement under which the buyer has the right to a specified quantity of concentrates located at the mill, and the seller is obligated to deliver that quantity at some designated time and place. The obligation is general, as opposed to designating specific drums or lots. The usual delivery arrangements between a uranium seller and the buying customer call for physical delivery or book transfer at a conversion facility.

In a physical delivery the seller ships the concentrates to the sampling facility adjacent to the converter designated by the buyer. The buyer typically takes delivery on-board carrier at the sampling plant, with the buyer paying 90 to 100 percent of the total purchase price on delivery, based on the seller's provisional analysis of the amount of concentrates delivered. Final payment between buyer and seller occurs after assay settlement (the procedure to finalize the quantity of concentrates actually delivered). However, assay settlement can take as long as three months, and even longer if the converters are exceptionally busy or if there is a dispute about the assay that requires resolution by umpire procedures*.

In order to avoid the delays (including payment delays) associated with physical delivery and to accommodate customers, many sellers elect to deliver by book transfer. In this procedure the seller establishes a "supplier account" with the converter (sometimes also referred to as a "receiving" or "holding" account) to which the concentrates are delivered. Deliveries to such an account are scheduled so that, when the time comes for the seller to deliver to the buyer, there are already sufficient "final pounds" in the account (following the aforementioned assay settlement procedure) to deliver the exact quantity. The delivery is accomplished by having the converter transfer, on its books, the specified quantity from the seller's account to the buyer's account. This simple accounting transaction is essentially the same as transferring funds at a bank. Book transfers involve commingling, and custom dictates that the resulting product be assigned the mine origins of the mill feed material unless the converter is directed to make a different assignment in its internal records. Again, the feed must match the product characteristics and the quantity must not be changed.

A variation of physical delivery involves the seller shipping material to its account at the converter and specifying that, following the determination of the final pounds of U_3O_8 equivalent contained in the material, all such final pounds, whatever the quantity, be transferred to a particular buyer's account.

There is also another significant variation in the procedures outlined above. Under certain circumstances converters will provide a seller with final pounds (based on the seller's provisional weights and assays, or perhaps 98 or 99 percent thereof), ready for book transfer, at the time of physical delivery of concentrates to the sampling plant. This procedure is generally available only when the seller in question has an established record of delivery, the converter is familiar with the quality of the seller's concentrates, and there is a sufficient balance in the seller's account to cover possible variances. Converters are generally willing to accommodate their customer's wishes in this regard, particularly when time-sensitive commercial matters are involved.

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* Umpire procedures are those used to resolve any differences between the provisional assay of the concentrates provided by the producer and the converter's assay of the same concentrates. The umpire procedure involves an independent organization performing an assay on concentrates samples that were taken at the same time as were the converter's samples.

Most deliveries at converters are made to utilities that have conversion accounts with that converter. Such accounts are established under the terms of a conversion contract between the utility and the converter. It is, of course, possible that the buyer is not a utility and not a conversion customer, in which case delivery may be made to a supplier account rather than to a conversion account. However, it is also possible that the non-utility entity may have established a conversion account with that converter, if it has an obligation to deliver UF_6 to a customer.

Finally, concentrates may be stored at commercial storage facilities or other licensed locations which may have no association with either uranium mining or conversion operations. Such arrangements are usually made when the owner of the concentrates:

1. Wishes to resell the uranium and, to retain maximum fungibility, wants to avoid committing it to a specific converter;
2. has yet to conclude a conversion contract;
3. has no near-term use for the concentrates, or;
4. is attracted by the lower storage charges at such facilities.

Factors Affecting Fungibility

Converters' Non-Removal Policies — With few exceptions, concentrates, once delivered to a converter, weighed, sampled and with the U_3O_8 equivalents credited to a customer's account, may not be removed from that particular facility, and *must* eventually be delivered as UF_6 to an end user (conversion customer) who has a conversion agreement with that converter. There are practical, operational reasons for such a non-removal policy, principally relating to the standard converter policy of protecting his right to convert the material, and the disruption in the flow of material caused by selecting, sampling and packaging material for withdrawal.

While any removal of concentrates from a converter would be unusual, it could conceivably occur as the result of a decision to terminate the contractual relationship between the converter and the owner of the concentrates, or in connection with litigation or other extraordinary circumstances. Since potential buyers are generally limited to those associated with that particular converter, concentrates located at a specific conversion facility are less fungible than concentrates that can be delivered anywhere. This disadvantage is, at least partially, offset by the fact that material stored at a converter can be delivered instantly by book transfer.

The difficulties (and costs) associated with removing concentrates from a particular conversion facility can generally be overcome through exchanges with other uranium market participants, and such exchanges are a common form of commercial activity.

Fees at Converters — Converters have, at times, charged fees for certain transfers within their facilities. The conventional form of transfer within a conversion facility is from a supplier account to a utility's conversion account. However, in the market environment of the past several years, other types of transfers also have become commonplace, including: from one supplier account to another supplier account, from one conversion account to another conversion account, and from a conversion account to a supplier account. The imposition of even a modest fee could be sufficient to destroy the economics of a transaction with a small profit margin. Current competitive pressures have led to the elimination of such fees.

Specific Policies and Capabilities of Different Converters — Because the individual converters differ as regards policies, processes, and capabilities, inherent institutional and operational constraints also exist. Thus, uranium in the form of slurry is only accepted for processing into UF_6 by certain converters. Uranium with certain chemical attributes, such as high sodium and/or potassium content, may be subject to higher surcharges or exceed rejection limits at one converter and not another. Different converters also may have different requirements for the identical transactions, and one converter may permit a transaction that another will not.

Storage at Converters — Uranium suppliers' accounts at converters exist for the purpose of facilitating deliveries to conversion customers. Supplier accounts are not intended to provide producers with a warehousing service for long term storage of concentrates. The contractual arrangements between a converter and a uranium supplier typically set a limit on the quantity of concentrates that may be in the supplier account and the length of time they may be kept there. In the case of concentrates that will not be delivered or converted for some time, the converter may require the supplier to conclude a storage agreement which provides for the payment of storage charges. Storage charges at US converters currently amount to about $0.01 per pound U_3O_8 equivalent per month.

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Outside Storage Facilities — Concentrates which are stored at commercial storage facilities usually have been weighed, sampled and assayed at one of the sampling facilities associated with a converter before transfer to the storage site. While this procedure allows the buyer and seller to settle financially and may allow the buyer to save on storage costs and defer selection of a converter, there are other, potentially negative consequences. Among these are incurring the additional transportation costs of shipping the concentrates back to a converter and the costs of re-sampling. It should be noted that even if the concentrates are shipped to the same converter that did the original sampling, the converter is likely to insist on re-sampling since the material was not continuously under its control. This disadvantage could be offset by lower fees charged by the commercial storage facility if the concentrates are to be stored for an extended period.

Restrictions Based on Origin — The national origins of concentrates also influence commerce, almost always in the form of restrictions resulting from laws and national or local policy considerations. Thus, as a consequence of legislation passed by the US Congress in 1986 (the Comprehensive Anti-Apartheid Act of 1986), South African or Namibian ore or oxides may no longer be imported into the USA. Similarly, due to the lack of appropriate bilateral safeguards agreements, Taiwan is unable to purchase uranium from Canada or Australia, US-origin material cannot be exported to Brazil or Argentina, nor can Canadian material be exported to Argentina. Some utilities, though not forbidden by law, have nevertheless elected not to use uranium of certain origins. In addition, the mere prospect of legislated or court-mandated restrictions on foreign uranium has led many US utilities to rearrange uranium inventories so as to preserve stocks of US-origin uranium. While the existence of such restrictions, whether real or threatened, limits the free flow of commerce, they have led to the development of new types of market mechanisms, designed to mitigate the inconvenience and extra costs of additional transportation-related expenses that would be dictated by such restrictions.

Conclusion

Despite constraints that may, at times, result from considerations of location, origin, form, ownership, and/or possession, it has usually proved possible, through exchanges and book transfers, to maintain uranium fungibility and to reduce the unnecessary costs of withdrawals, shipments and alternative processing that may result from such restrictions. The act of commingling for process efficiency has been accepted by law, and custom has dictated practices that allow reasonable efficiency without contravention of established national and international regulations. The main obstacles likely to impede uranium commerce in the future will continue to be the various political restrictions that may be applied by government entities, whether to protect domestic industries, to advance national non-proliferation aims, or to apply economic sanctions.

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WORLD URANIUM PRODUCTION IN 1987

Introduction]

World uranium production, excluding communist countries (for which little reliable information is available), totaled approximately 94.9 million pounds U_3O_8 (about 43,000 metric tonnes U_3O_8) in 1987, a 2.5 percent drop from the 1986 figure of 97.3 million pounds (Table 1). Of the top four producing countries, Australia, South Africa and the USA registered decreases, while Canada, the foremost producer, increased output in 1987.

Australia

Australia's 1987 production totaled approximately 9.8 million pounds U_3O_8, a decrease of about one million pounds from the 1986 figure of 10.8 million pounds. Australia's share of the world uranium market also decreased slightly, from approximately 11.2 percent in 1986 to 10.3 percent in 1987. 1987 production came entirely from two producers, Energy Resources of Australia (ERA) and Queensland Mines Limited (QML).

Energy Resources of Australia — ERA's Ranger mine at Jabiru produced 6.8 million pounds U_3O_8, down from its 1986 level of 7.7 million pounds. ERA concluded new long-term contracts with two US utilities in 1987, bringing the total number of US contracts to eleven, and it is likely that two more such contracts will be announced in the first half of 1988. A new long-term contract with Electricite de France (EdF) also was signed, as part of Cogema's purchase (from Germany's Saarberg Interplan) of a 1.25 percent interest in ERA, the first such French equity participation in a producing Australian uranium project. ERA is also reported to have reached agreement with its shareholder-customers on a number of contract issues that have been in contention for some years. While the exact terms have not been made public, the settlement reportedly included lower prices, as well as additional tonnage, contract extensions, and the limitation of certain termination rights.

Queensland Mines — QML's Nabarlek project in the Northern Territory produced nearly 3.0 million pounds U_3O_8, all from ore stockpiled at the mill site. QML continued to deliver uranium to customers in Japan and in Europe, and a modest contract extension was concluded

Table 1

HISTORICAL WORLD[1] URANIUM PRODUCTION[2], 1983-87
(Millions of Pounds U_3O_8)

	Production/ Market Share[3] 1983	1984	1985	1986	Production/ Market Share[3] 1987	Percent Change from 1986
Australia	8.4 (8.8%)	11.4	8.5	10.8	**9.8** (10.3%)	- 9.3
Canada	18.6 (19.4%)	29.0	28.3	30.5	**32.3** (34.0%)	+ 5.9
France	8.5 (8.9%)	8.2	8.3	8.5	**8.6** (9.1%)	+ 1.2
Gabon	2.6 (2.7%)	2.4	2.4	2.2	**2.1** (2.2%)	- 4.5
Namibia	9.7 (10.1%)	9.6	9.0	9.1	**9.2** (9.7%)	+ 1.1
Niger	8.9 (9.3%)	8..6	8.2	8.2	**7.8** (8.2%)	- 4.9
South Africa	15.7 (16.4%)	14.9	12.6	12.0	**10.3** (10.9%)	- 14.2
United States	21.2 (22.1%)	14.9	11.3	13.9	**12.5** (13.2%)	- 10.1
Other[4]	2.2 (2.3%)	2.0	2.0	2.1	**2.3** (2.4%)	+ 9.5
WORLD TOTAL	95.8	101.0	90.6	97.3	**94.9**	- 2.5

[1] Outside Soviet bloc areas.

[2] Figures presented are Nuexco's best estimates.

[3] Expressed as a percentage of total production. Column total may not equal 100 percent due to independent rounding.

[4] Includes Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, and Yugoslavia.

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with one customer. It is estimated that the ore stockpile now contains less than one million pounds of additional, recoverable U_3O_8, and that milling operations will be concluded by mid-1988. At that time, the company must either put the mill on a care-and-maintenance basis or begin the cleanup and decommissioning process. Although QML currently lacks sufficient, uncommitted production from Nabarlek to compete with other Australian sellers in the long-term market, negotiations with the Northern Land Council are progressing with respect to QML's gaining new exploration rights in the potentially uranium-rich areas surrounding Nabarlek.

Olympic Dam — Development of the mining and milling facilities and associated infrastructure at this large, multi-mineral operation continued during 1987, and startup of uranium production remains on schedule for mid-1988. The project's uranium output is currently targeted at 4.2 million pounds U_3O_8 annually, of which about 50 percent is under long-term contract at the present time. A 1986 contract with the Swedish State Power Board was followed in 1987 by contracts with the UK's Central Electricity Generating Board and Korea Electric Power Company, and a contract with a Japanese utility also is reportedly under negotiation.

Figure 1. Open-pit mine at Lodeve, France.

Canada

For the fourth year in a row, Canada led the world in uranium production in 1987, accounting for more than one-third of all U_3O_8 production worldwide. Canadian mining and milling centers produced 32.3 million pounds U_3O_8 in 1987, a six-percent increase from the 1986 level (Table 2).

The province of Saskatchewan was responsible for about two-thirds of this total output, as the Key Lake project again exceeded its 12-million pound rated capacity. Key Lake production totaled slightly more than 13.5 million pounds U_3O_8, an increase of almost one million pounds over the previous year's record output. The **Key Lake Joint Venture** is owned by the Saskatchewan Mining Development Corp. (SMDC, 50 percent), Uranerz Exploration and Mining (33.3 percent), and Eldorado Resources (16.7 percent). The milling of high-grade ore from the Collins "B" orebody increased output at **Eldorado's** newly-renovated Rabbit Lake mill to 5.7 million pounds, contributing to the overall production increase. At Cluff Lake, **Amok Ltd.** produced 2.15 million pounds U_3O_8, a slight decrease from the 1986 level.

Uranium production in Ontario declined in 1987, partly the result of a three-week strike in the Elliot Lake district. **Denison Mines Ltd.** and **Rio Algom** produced 4.7 million and 6.2 million pounds U_3O_8 respectively in 1987, a drop of approximately 10 percent and 15 percent respectively.

Both exploration and new project development continued in 1987, primarily in Saskatchewan and the Northern Territories. In October 1987, the Saskatchewan Environment Department gave its approval for test mining of the Cigar Lake deposit, the world's largest high-grade uranium deposit. The **Cigar Lake Mining Corporation**, owner of the project, plans to begin sinking a 500-meter exploratory test shaft in early 1988, as part of a two-year test period that will include site development, and a determination of technical feasibility for full-scale production. The test phase will involve mining up to 5,000 metric tons of ore. Commercial production is expected to begin in 1993.

Eldorado Resources also contined to conduct delineation drilling on its wholly-owned Eagle South deposit, as well as on the Eagle North deposit, which is owned by a joint venture of Eldorado, SMDC and Noranda. The two deposits together are estimated to contain over 130 million pounds U_3O_8, with average ore grades between one and two percent U_3O_8. The Saskatchewan Environment Division granted the necessary permits for the development of the Eagle Point and Collins "A" and "D" deposits in January 1988. **Denison Mines** completed purchase of a 60-percent interest in the Midwest Lake deposit, where it plans to conduct feasibility studies that could lead to shaft development as soon as 1988. **Minatco**, a subsidiary of France's Total Compagnie Miniere, has a permit for underground exploration at its McClean Lake property, but the company has not announced its plans for underground work at that site.

In its annual assessment of Canada's uranium resources, the Ministry of Energy, Mines and Resources significantly increased reserve estimates. As of the end of 1986, Canada's total known uranium resources (including measured, indicated and inferred categories) were estimated at 567,000 metric tons of uranium (MTU), or almost 1.5 billion pounds U_3O_8. Continuing delineation drilling of deposits in Saskatchewan accounted for most of the 16,000 MTU increase since the 1984 figure, the last time the full assessment was performed.

South Africa and Namibia

Uranium production in the Republic of South Africa continued to decline in 1987, to approximately 10.3 million pounds U_3O_8, a drop of 14.2 percent from the previous year's total of almost 12 million pounds (Table 3). These figures include production from both Chamber of Mines producers and the Palabora Mining Company. Part of the decline resulted from labor disruptions caused by the lengthy strike called by the Mineworkers Union, which caused third-quarter output to drop substantially at several mines, including **Freegold** (down 6 percent since 1986), **Randfontein** (down 23 percent), **Vaal Reefs** (down 13 percent) and **Western Areas** (down 23 percent). In addition, **Buffelsfontein** experienced a 25-percent drop in annual production due to lower ore recovery and insufficient ore

Table 2

CANADIAN URANIUM OUTPUT, 1986-1987

Company or Mine	Province	Production (Thousands of Pounds U_3O_8) 1986	1987	Percent Change[1]
Denison Mines Limited	Ontario	5,239	4,703	- 10.2
Rio Algom Limited	Ontario			
— Quirke		3,273	3,000	- 8.3
— Panel		2,303	2,000	- 13.2
— Stanleigh		1,737	1,200	- 30.9
Amok Ltd.	Saskatchewan	2,167	2,150	- 0.8
Eldorado Resources Ltd. (Rabbit Lake)	Saskatchewan	3,190	5,699	+ 78.7
Key Lake Joint Venture[2]	Saskatchewan	12,590	13,517	+ 7.4
TOTAL:		30,499	32,269	+ 5.8

[1] From previous year.
[2] SMDC 50%, UEM 33%, Eldorado 17%.

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Table 3

REPUBLIC OF SOUTH AFRICA RECENT URANIUM PRODUCTION[1]

(Thousands of Pounds U_3O_8)

Operation	Total 1986	First Quarter 1987	Second Quarter 1987	Third Quarter 1987	Fourth Quarter 1987	Total 1987	Percent Change[2]
Buffelsfontein	1,316	271	245	240	229	985	- 25.2
Driefontein Consolidated	180	41	41	42	36	161	- 10.6
ERGO[3]	343	88	79	85	93	345	- 0.6
Freegold[4]	1,168	275	245	223	277	1,020	- 12.7
Harmony	728	102	103	97	90	393	- 46.0
Hartebeestfontein	1,025	242	231	223	219	916	- 10.6
Randfontein	1,324	314	297	148	259	1,019	- 23.0
Stilfontein (Chemwes)	638	228	234	232	239	933	+ 46.2
Vaal Reefs	4,255	1,025	977	768	927	3,697	- 13.1
Western Areas	585	127	104	124	98	452	- 22.7
Palabora Mining Co.	408	87	87	87	87	346	- 15.2
TOTAL[5]	11,970	2,801	2,642	2,270	2,553	10,266	- 14.2

[1] Includes both Chamber of Mines producers and the Palabora Mining Co., which does not belong to the Chamber of Mines.

[2] Change in percent from 1986 total.

[3] ERGO = East Rand Gold and Uranium Company Ltd.

[4] Formerly Free State Joint Metallurgical Scheme.

[5] Columns may not add due to rounding.

reserves in its Strathmore Shaft Area. Output from **Harmony** declined 46 percent from 1986, primarily due to the closure of its Virginia plant in mid-1986. The only significant increase came from **Stilfontein's** Chemwes facility, up 48 percent from the 1986 level. The increase came from additional sales and bringing forward deliveries that were due in 1990 and 1991; this enabled an increase in plant capacity utilization from 80 percent in 1986 to 100 percent in 1987. Production at **Palabora** was 346,000 pounds U_3O_8, a drop of 15 percent from the 1986 total of 408,000 pounds.

In Namibia, **Rossing Uranium Ltd.**'s Rossing project maintained steady production, estimated at 9.2 million pounds U_3O_8, a slight increase over 1986.

USA

US uranium production of approximately 12.5 million pounds U_3O_8 (Table 4) represented a decline of about 10

Table 4

DISTRIBUTION OF US PRODUCTION BY TYPE*

(Millions of Pounds U_3O_8)

	1982	1983	1984	1985	1986	1987
By-Product	3.2	3.1	3.1	3.6	3.6	3.7
Conventional	20.6	15.3	9.7	5.6	8.8	7.8
Solution Mining	3.0	2.8	2.1	2.1	1.5	1.0
Total	26.8	21.2	14.9	11.3	13.9	12.5

*Nuexco estimates.

percent from 1986, when 13.8 million pounds were produced. Conventional production accounted for about 62 percent of the total, little changed from the previous year, while solution mining accounted for 8 percent (down from 11 percent) and by-product production from phosphates amounted to about 30 percent (up from 26 percent). Three key factors were largely responsible for the drop in US production:

1. In January 1987, Cotter Corporation suspended operations at its Schwartzwalder, Colorado underground mine and its Canon City, Colorado mill. 1986 production from the Schwartzwalder mine was 730,000 pounds U_3O_8.

2. USX Corporation's (formerly U. S. Steel) south Texas solution mining operations at Clay West changed over from production to restoration. Clay West had produced 550,000 pounds U_3O_8 in 1986.

3. The Umetco Minerals Corp./Energy Fuels Nuclear Inc. White Mesa mill at Blanding, Utah produced 4.5 million pounds U_3O_8, a decline of 400,000 pounds from the previous year.

Conventional Production

The Colorado Plateau and the Arizona Strip — The leading US uranium producer was **Energy Fuels Nuclear** and its Swiss partners, which produced approximately 3,800,000 pounds U_3O_8, largely from high-grade (over 0.30 percent U_3O_8) breccia-pipe ores found in northern Arizona. **Umetco Minerals Corp.**, a subsidiary of Union Carbide Corp., produced about 700,000 pounds U_3O_8 from mines on the Colorado/Utah border, and together with Energy Fuels, supplied the ore for the White Mesa mill, which is 70-percent owned by Umetco.

Rio Algom Corp. continued to operate its Lisbon, Utah mill, producing about 700,000 pounds U_3O_8 in 1987, using both company and outside-source ore. **Homestake Mining Co.** also produced about 400,000 pounds from its Section 23 mine in the Grants, New Mexico area.

The South Texas Region — **Chevron Resources Co.**'s Mt. Taylor mine, near Grants, New Mexico, continued in operation throughout 1987, producing approximately 1.5 million pounds U_3O_8. Production at Mt. Taylor involves mining about 600 tons per day of ore, with an average grade of 0.50 percent U_3O_8, then shipping the ore over 900 miles by rail to Chevron's Panna Maria mill. Recently, however, some Mt. Taylor ore has been milled at the Homestake mill near Grants.

About 80 miles south of Panna Maria, a joint venture of Chevron (60 percent) and **Total Minerals Corp.** (40 percent) started development of the Rhodes Ranch deposit, the first new open-pit uranium mine in the USA since the late 1970s. The mine is expected to produce about one million pounds U_3O_8 in 1988.

Colorado and Wyoming — **Cotter Corporation's** Schwartzwalder mine near Golden, Colorado suspended operation in January 1987. Ore from the mine had been shipped to the company's mill in Canon City, Colorado, which also has been placed on stand-by. In Wyoming, ore stockpiled from **Pathfinder Mines Corporation's** Shirley Basin and Gas Hills sites together was milled to produce over 500,000 pounds U_3O_8 in 1987. The mill at Gas Hills, which had been closed for more than two years, was refurbished and placed in operation in July 1987, even though the mines themselves remain closed.

Solution Mining

The overall share of US uranium produced from solution mining decreased 3 percent in 1987, as production dropped to under one million pounds U_3O_8 for the first time since 1975. Two major producing sites in Texas ceased production in 1987, and began restoration activities:

1. The Clay West project, jointly owned by USX Corp. (50 percent, operator) and **Niagara Mohawk Power Corp.** (50 percent), produced approximately 100,000 pounds U_3O_8 before changing over from production to restoration. The project's maximum output was 1.2 million pounds U_3O_8 in 1981.

2. **Everest Minerals'** Mt. Lucas project stopped producing uranium in 1987, after averaging about 500,000 pounds U_3O_8 per year since 1984. However, in December 1987, Everest started up the Tex-1 project, which, in conjunction with the nearby satellite Gruy project, expected to begin production in 1988, is expected to produce 500,000 pounds U_3O_8 annually.

In late 1987, **Malapai Resources Co.** bought the Holiday/El Mesquite and O'Hern properties in south Texas from Mobil Oil. Output during 1987 is estimated to be approximately 140,000 pounds U_3O_8. **Intercontinental Energy Corp.** produced about 100,000 pounds U_3O_8 at its Lamprecht facility. **Uranium Resources Inc.** has been preparing its Kingsville Dome and Rosita projects for 1988 production; once the projects are in full production, they are expected annually to produce 800,000 and 500,000 pounds U_3O_8, respectively. **Total Minerals Corp.** acquired the West Cole project from Tenneco Minerals in 1987, and has been reactivating the facility, which was placed on stand-by in 1984.

In Wyoming, **Malapai Resources** acquired the Irigary property from Westinghouse, restarting the plant in late 1987. Malapai expects 1988 production to reach 250,000 pounds U_3O_8. **Everest Minerals** also expects to begin production in 1988 at its Highland, Wyoming property, at a rate of 800,000 pounds U_3O_8 per year. **Ferret Exploration Co.** submitted an application to begin production in 1989 from its Crow Butte, Nebraska project. Initial production is expected to be over 500,000 pounds U_3O_8 per year, with capabilities as high as perhaps one million pounds per year.

By-Product Production

Uranium produced as a by-product of phosphoric acid processing and other techniques totaled approximately 3.5 million pounds U_3O_8 in 1987, accounting for 30 percent of total US output. **International Minerals and Chemical Co.** and **Freeport Uranium Recovery Co.** produced about 1,900,000 and 1,200,000 pounds U_3O_8 respectively from their phosphate production operations in Louisiana and Florida. **Rhone Poulenc** also recovered approximately 30,000 pounds U_3O_8 from the processing of rare earth oxides at its Freeport, Texas plant. In the Grants, New Mexico district, **Homestake Mining Co.** and **Quivira Mining Co.** recovered a total of about 400,000 pounds U_3O_8 in 1987 from mine waters in conventional underground mines, most of which are no longer in operation. **Energy Fuels** recovered approximately 120,000 pounds U_3O_8 as a by-product of copper operations at Bingham Canyon, Utah.

Other Countries

Europe — Uranium production in Europe increased about 2 percent over 1986, led by France, whose 1987 output totaled 8.6 million pounds U_3O_8. Of this amount, Cogema accounted for 84 percent through its operations at Herault, Vendeed, Crouzille and Langogne. Total Compagnie Miniere-France produced the remainder at its Chebois unit in Haute-Vienne.

Spanish uranium production increased marginally, to 572,000 pounds U_3O_8 (Figure 2). Portuguese production

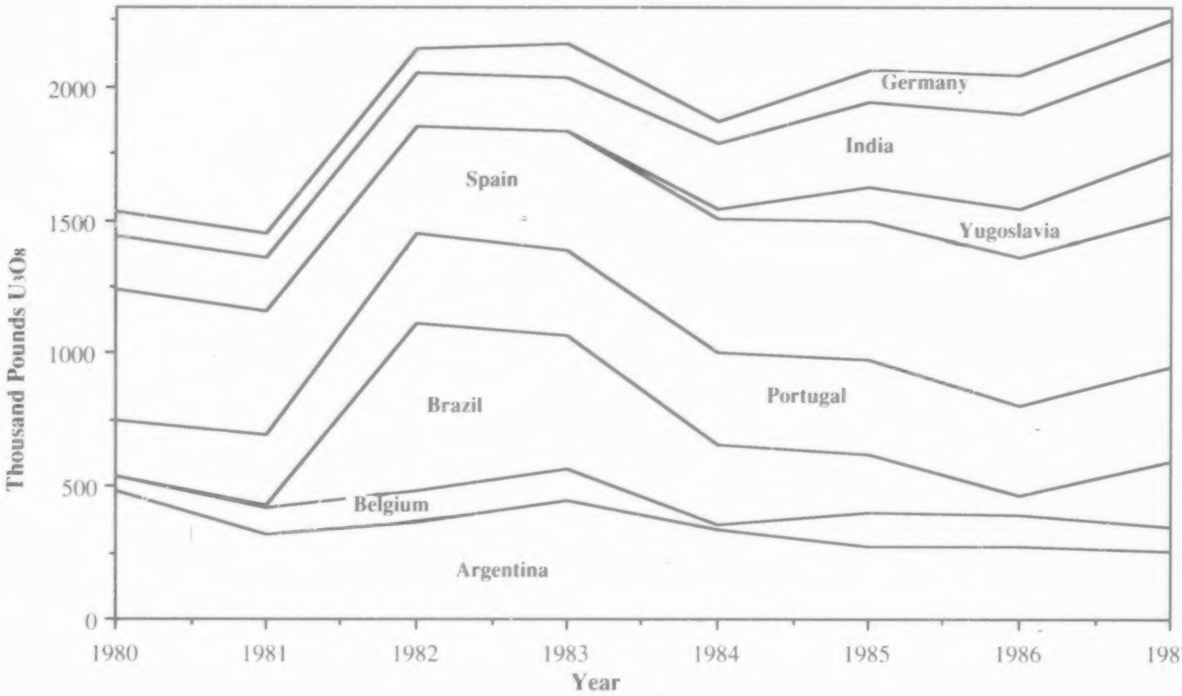

Figure 2

1987 URANIUM PRODUCTION IN SELECTED COUNTRIES

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remained steady at about 350,000 pounds U_3O_8 from Urgeirica. In Belgium, by-product uranium from phosphoric acid production declined to 91,000 pounds from the 1986 level of about 120,000 pounds U_3O_8.

In Germany, Saarberg-Interplan produced approximately 50,000 pounds U_3O_8 from its test mining program at the Grossschloppen project and Gewerkschaft Brunhilde continued production at Ellweiler at a rate of about 90,000 pounds U_3O_8 per year. The Zirovski project in Yugoslavia increased output 30 percent over 1986, to 234,000 pounds U_3O_8.

Central Africa — Compagnie des Mines d'uranium de Franceville (COMUF) produced 2.1 million pounds U_3O_8 at its Mounana operation in Gabon, down slightly from the 1986 total of 2.2 million pounds. Niger's 1987 output of 7.8 million pounds U_3O_8 from its Arlit and Cominak operations represent a 5-percent decrease from 1986, all of which is attributable to the Arlit mine, where production has declined from over 5 million pounds in 1982 to 2.6 million pounds U_3O_8 in 1987.

South America — In Brazil, Nuclebras increased production at its Pocas de Caldas complex from 77,000 pounds U_3O_8 in 1986 to 252,000 pounds in 1987. Production in Argentina decreased by 7 percent as the Malargue project was closed and the Los Gigantes project experienced continuing production difficulties. Total 1987 production was approximately 250,000 pounds U_3O_8.

Asia — India remained the largest uranium producer in Asia, outside of China, with 1987 production from both conventional and copper by-product operations estimated to be 360,000 pounds U_3O_8. China produces significant quantities of uranium, but information on Chinese production is highly classified by the government, and much of their production has been for military purposes. Japan produces a few thousand pounds U_3O_8 per year from various pilot programs. Pakistan is reported to have recently started up a uranium production complex at Dera Ghazi Khan, with an estimated capacity of about 60,000 pounds U_3O_8 per year.

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CANADA

On February 22, 1988, the Canadian and Saskatchewan governments announced that a letter of intent had been signed, calling for the merger of Eldorado Nuclear Limited (Eldorado) and the Saskatchewan Mining Development Corporation (SMDC). The merger, to form an as-yet unnamed new company, is targeted for completion by mid-1988, but until finalized, both companies will continue to carry on "business as usual." The merger announcement also noted the commitment to fully privatize the new organization within seven years. The new company would be headquartered in Saskatoon, Saskatchewan. Some of the details thus far released include:

1. *Schedule* — The proposed merger is to be put into effect by July 1, 1988. Before the final agreement can be signed, the Canadian federal government and the government of Saskatchewan must enact enabling legislation, and the merger will be examined for compliance with the Competition Act.

2. *Ownership structure* — The new company will initially be owned by the Saskatchewan government (61.5 percent) and the government of Canada (38.5 percent). This ownership distribution is reportedly based on evaluations of the two existing companies' assets and debts and on the potential future contributions of the companies. The founding shareholders in the new company also will receive a debt issue, estimated at about 40 percent of the net assets, in proportion to their share of the holdings.

3. *Privatization* — A divestiture schedule has been established, under which the two government shareholders together will reduce their holdings in the new venture to a total of 70 percent within two years, with further reductions to 40 percent within four years, and to zero percent within seven years.

4. *Controlling Interest and Foreign Participation* — No single Canadian shareholder (or related group) may hold shares totaling more than 25 percent of voting rights. Single non-Canadian shareholders (or related groups) will be limited to holdings carrying no more than 5 percent of the voting rights. In total, non-Canadian interests will be prohibited from exercising more than 20 percent of the voting rights.

The new company's holdings will include:

1. *The Key Lake Complex* — 66.7 percent of the Key Lake project, including the mill and associated deposits, estimated to continue producing some 12 to 14 million pounds U_3O_8 annually through at least the end of the century;

2. *The Rabbit Lake Complex* — 100 percent of the Rabbit Lake operation, which, supported by the nearby high-grade Collins Bay and Eagle Point deposits, is projected to produce 5 to 7 million pounds U_3O_8 annually, well into the next century;

3. *Cluff Lake* — 20 percent of Cluff Lake, expected to produce over two million pounds U_3O_8 per year into the next century;

4. *Cigar Lake* — 48.75 percent of the Cigar Lake project, with estimated reserves totaling 385 million pounds U_3O_8 at grades of 5 to 14 percent U_3O_8;

5. *Dawn Lake* — 50 percent of Dawn Lake, with estimated reserves of 30 million pounds U_3O_8 at a grade of approximately 2 percent U_3O_8.

6. *Refining and Conversion Facilities* at Blind River, and Port Hope, Ontario, currently operated by Eldorado.

Assuming that the merger is completed as planned, the resulting new entity would be the world's largest and lowest cost uranium producer. Based on 1987 production results, the two companies' combined production was more than 15 million pounds U_3O_8, representing 16 percent of WOCA production last year. Including only the major deposits associated with the existing Rabbit Lake and Key Lake operations, as well as Cigar Lake and Cluff Lake, the new company would control high-grade reserves currently (and conservatively) estimated to contain over 500 million pounds U_3O_8. In addition, it would hold Eldorado's modern conversion and UO_2 production facilities in Ontario.

The new company's sheer size, existing production operations, extensive high-grade reserves and experienced staff will make it the largest single force in the world uranium market. Some buyers already have expressed concern that the elimination of competition between Canada's two largest and most aggressive sellers could lead, in the near-term, to higher prices in both the spot and longer-term markets. Others believe that such concerns are exaggerated and premature, pointing out that the likelihood of a new round of inventory liquidations in the already soft spot market, and the apparent emergence of newly-aggressive Australian sellers seeking a share of the long-term market, will provide effective price discipline.

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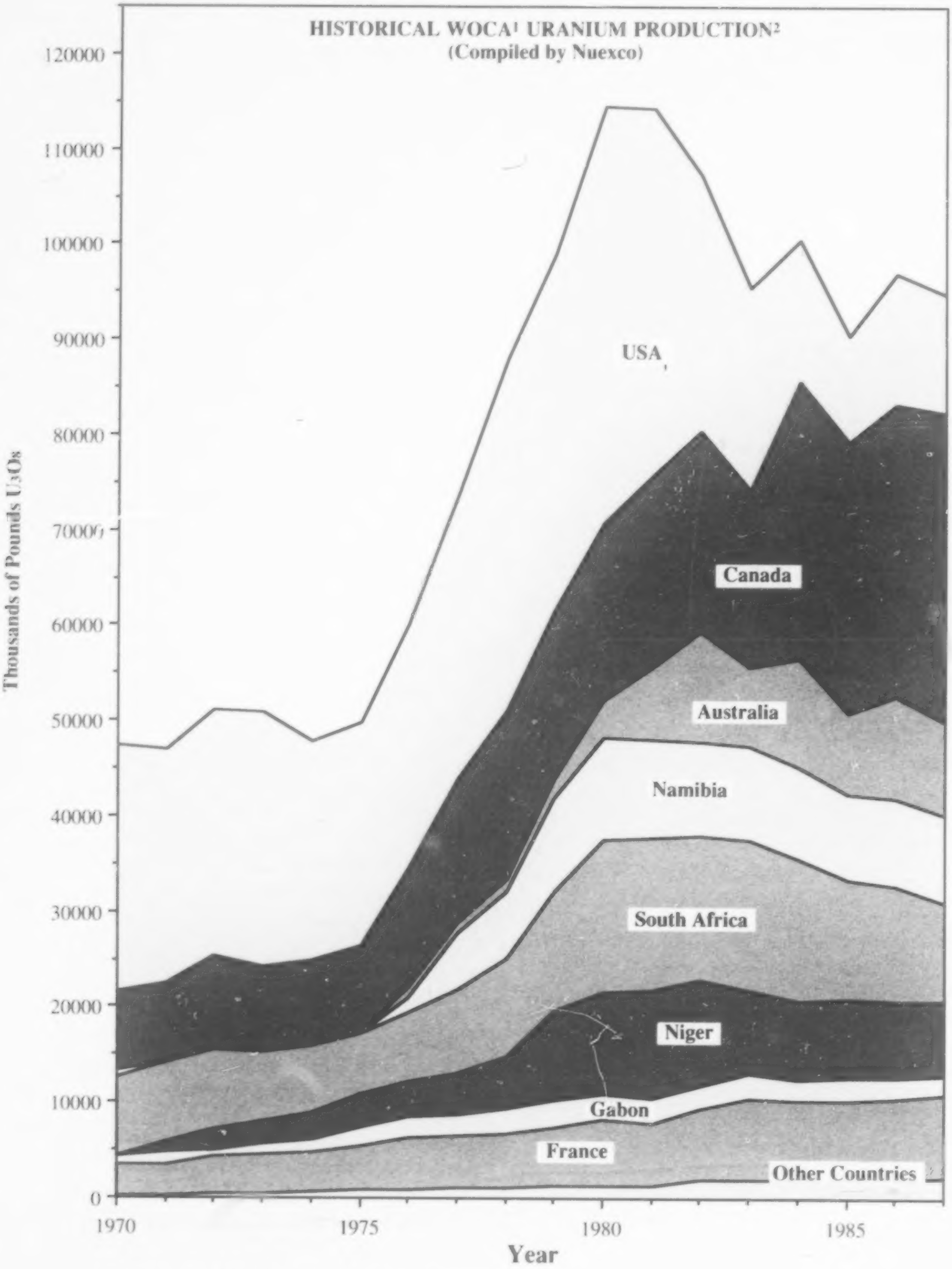
HISTORICAL MARKET DATA



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[1] WOCA = World Outside of Centrally-Planned Economic Areas.
[2] 1987 production data are preliminary.

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969		6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	
1988	16.30	**16.15**										

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	**0.50**										

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	**16.65**										

HISTORICAL MARKET DATA

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	**1.80**										

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	**46.00**										

HISTORICAL US UF_6 PREMIUM (Relative to the UF_6 Value)

Determined as of the last day of the month indicated ($US/kg U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	**1.25**										

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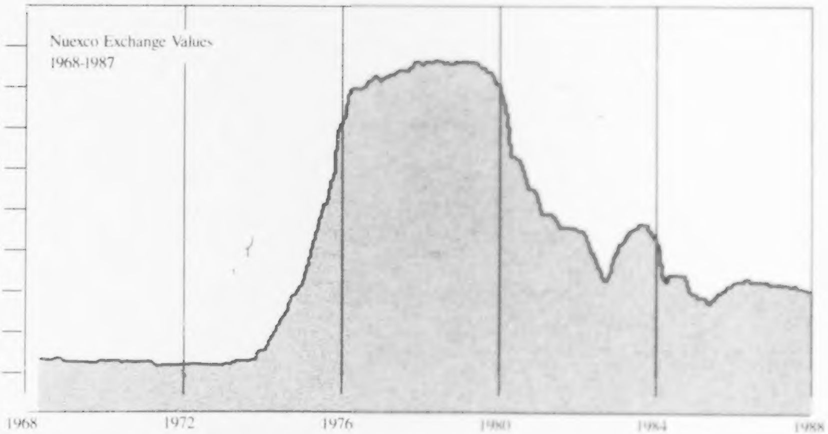
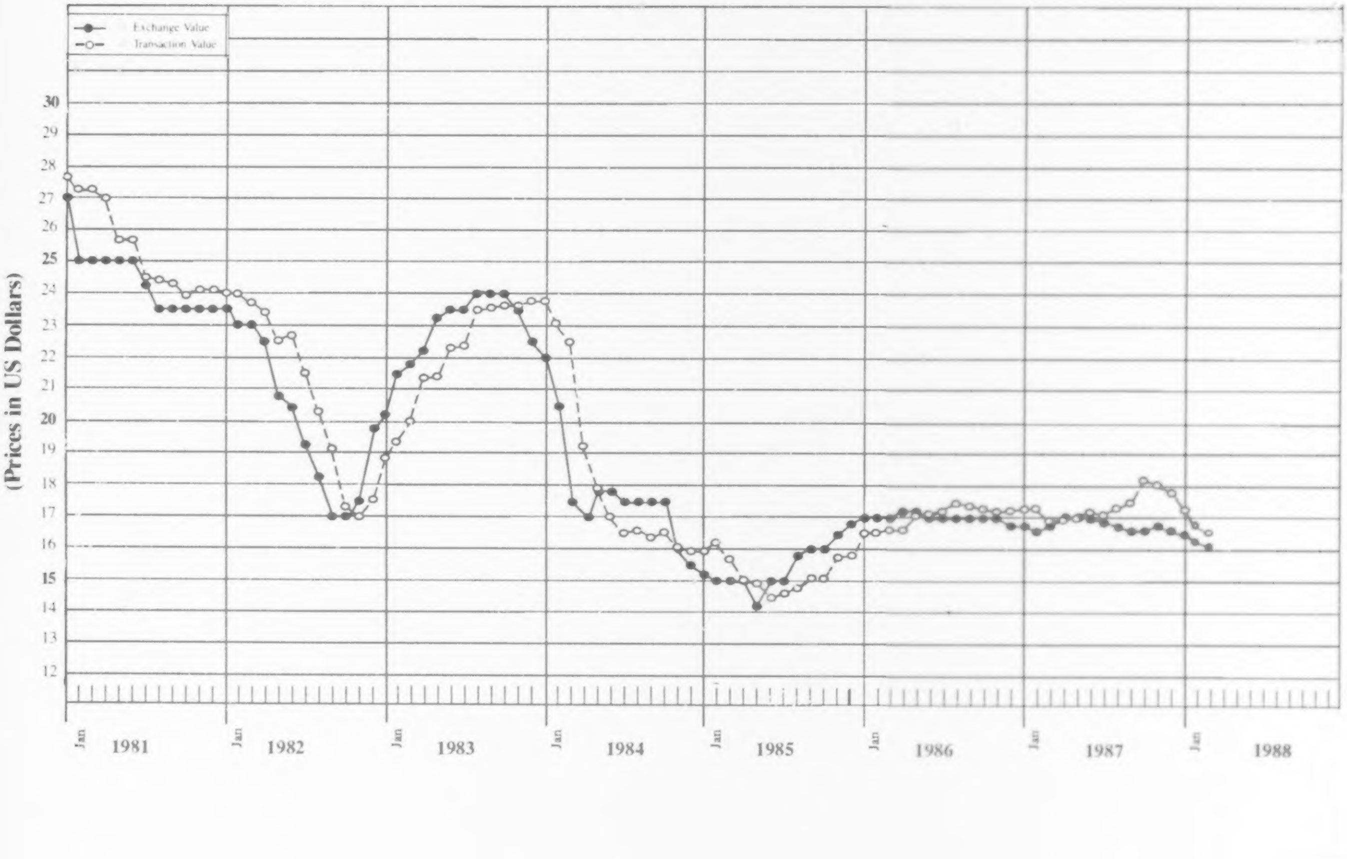
HISTORICAL MARKET DATA





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HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]

(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	202.7
1986	Avg.	155.5	101.5	213.0
Jan	1987	—	106.2	215.9
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2
Apr	1987	—	108.3	222.2
May	1987	—	108.1	222.0
June	1987	167.2	108.1	221.8
July	1987	—	108.7	221.1
Aug	1987	—	110.5	222.3
Sep	1987	170.0	109.3	223.1
Oct	1987	—	108.6	—
Nov	1987	—	110.0	—

P = Preliminary R = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2R	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8R	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.0	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.4R	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1R	140.4	20.47	17.50R	16.50R	12.63R	13.53R
Dec	1987	125.4R	140.5	20.96P	17.32P	16.42P	12.52P	13.66P
Jan	1988	126.4	140.8	—	—	—	—	—

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975	Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976	Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977	Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978	Avg	27.[illegible]4	—	40.3	74.3	658,261	1,502,975
1979	Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
Jan	1987	—	—	128.9	233.9	750,496	529,682
Feb	1987	—	—	130.3	237.0	757,872	598,986
Mar	1987	88.17	197.1	132.4	239.6	762,697	536,006
Apr	1987	—	—	134.1	242.5	761,850	533,487
May	1987	—	—	135.6	243.6	759,428	530,918
Jun	1987	90.74	203.5	136.6	244.9	759,433	573,546
July	1987	—	—	138.2	246.8	681,409	542,908
Aug	1987	—	—	140.2	249.9	—	—
Sep	1987	100.79	224.7	142.0	252.4	—	—
Oct	1987	—	—	143.6	255.5	—	—
Nov	1987	—	—	144.8	257.1	—	—
Dec	1987	100.34	267.0	145.9	258.3	—	—
Jan	1988	—	—	147.2	—	—	—

P = Preliminary   R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria.

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UNITED STATES

		Producer Price Index[1]		Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	274.8	268.8	246.8	85.7	10.26	10.63	8.30	6.94
1981	Avg.	304.1	293.4	272.4	94.0	11.55	11.98	9.12	7.62
1982	Avg.	312.3	299.3	289.1	100.0	12.31	12.93	9.96	8.21
1983	Avg.	315.7	303.1	298.4	103.9	12.58	13.43	10.58	8.67
1984	Avg.	322.6	310.3	311.1	107.7	13.05	13.43	11.07	9.04
1985	Avg.	323.8	308.7	322.2	111.2	13.38	13.74	11.56	9.46
1986	Avg.	312.2	299.8	328.4	114.1	13.20	13.49	11.98	9.65
Jan	1987	313.5	300.9	333.1	—	12.94	12.98	12.18	9.84
Feb	1987	314.9	302.2	334.4	—	12.99	12.83	12.21	9.84
Mar	1987	315.7	302.7	335.9	116.1	13.04	12.79	12.24	9.84
Apr	1987	317.3	305.0	337.7	—	13.16	12.90	12.30	9.82
May	1987	318.3	307.1	338.7	—	12.97	12.92	12.31	9.83
Jun	1987	319.9	308.2	340.1	117.2	13.05	12.93	12.27	9.84
Jul	1987	322.1	309.8	340.8	—	13.06	13.07	12.37	9.89
Aug	1987	323.8	310.6	342.7	—	13.03	13.07	12.34	9.90
Sep	1987	323.3	310.4	344.4	117.8	13.19	13.44	12.56	9.98
Oct	1987	324.9	311.4	345.3	—	12.96	13.06	12.52	9.95
Nov	1987	325.4	311.9	345.8	—	12.89	13.10R	12.56R	10.00R
Dec	1987	325.3	311.7	345.7	118.7	12.78P	13.16P	12.61	10.07R
Jan	1988	104.3[5]	104.5[5]	115.7	—	—	—	12.62P	10.05P

P = Preliminary R = Revised since last month

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[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233..

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

[5] 1982 = 100.

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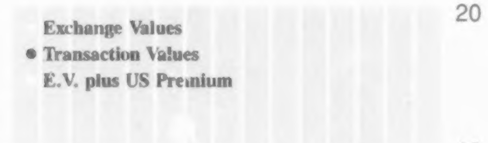
NUEXCO

Monthly Report

April 1988 Number 236

USEC Contract Terminations 3

Uranium Production in France 14



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NUEXCO

EXECUTIVE SUMMARY
REPORT 236
(All data as of March 31, 1988)

Exchange Value $15.90, down $0.25	The **Exchange Value** is **$15.90** per pound U_3O_8, down $0.25 since last month. The US Premium (relative to the Exchange Value) is $0.15, down $0.35 since last month.
UF_6 Value $45.50, down $0.50	The **UF_6 Value** is **$45.50** per kg U as UF_6, down $0.50 since last month. The US Premium (relative to the UF_6 Value) is $0.50, down $0.75 since last month.
Transactions	**Twelve** recent natural uranium sales are reported, involving **over 12 million** pounds equivalent U_3O_8. Six of the sales involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **6.0 million** pounds U_3O_8 equivalent, down 1.1 million pounds since last month. Active spot and near-term **uranium demand** totals **2.5 million** pounds, unchanged from last month. The spot and near-term **supply-demand ratio** decreased to **2.4 to 1**.
Transaction Value $16.55, down $0.10	The **Transaction Value** is **$16.55** per pound U_3O_8, **down $0.10** since last month. The calculation includes 24 transactions involving a total of 3.1 million pounds U_3O_8 and equivalent UF_6 and covers a period of 4 months.
Loan Rate 3.5%, unchanged	The **Loan Rate** is **3.5 percent** per annum, unchanged. No loan transactions are reported.
Conversion Value $1.80, unchanged	The **Conversion Value** is **$1.80** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 150,000 pounds U as UF_6. Active demand totals 750,000 pounds U as UF_6. One secondary market conversion transaction is reported.
SWU Value $70, down $3.00	The **SWU Value** at .3% tails assay is **$70** per SWU, down $3.00 since last month. No secondary market SWU transactions are reported.

* * *

Raw Materials	For the past several years, uranium production in France has averaged about 8 million pounds U_3O_8 per year, or about nine percent of the world total in 1987. This article examines the geology, history and organization of the French uranium industry, including the role of Cogema and other companies active in this area.

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NUEXCO REPORT 236 FIGURES OF THE MONTH (March 31, 1988)	This Month (Report 236)	Last Month (Report 235)	12 Months Ago (Report 224)
Exchange Value (\$US per pound U_3O_8)	15.90	16.15	17.00
US Premium for the Exchange Value (\$US per pound U_3O_8)	0.15	0.50	1.50
UF_6 Value (\$US per kg U as UF_6)	45.50	46.00	48.00
US Premium for the UF_6 Value (\$US per kg U as UF_6)	0.50	1.25	3.50
Transaction Value (\$US per pound U_3O_8 equivalent)	16.55	16.65	16.95
Loan Rate (Per Annum)	3.5%	3.5%	3%
Conversion Value (\$US per pound U as UF_6)	1.80	1.80	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	6.0	6.6	3.5
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	2.5	2.5	1.8
Near-Term Supply-Demand Ratio	2.4	2.7	1.9
Recent Uranium Sales:[3]			
Number of Transactions	12	4	10
Quantity of Material (Millions of pounds U_3O_8 equivalent)	12.6	0.4	2.2
Nuexco SWU Value: (\$US per SWU):			
at 0.30 tails assay	70	73	77
US DOE SWU Prices: (\$US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6[8]: (\$US per kg U as UF_6)			
2.5 w/o U_{235}	421	433	455
3.0 w/o U_{235}	539	553	582
3.5 w/o U_{235}	658	676	711
4.0 w/o U_{235}	779	801	842

---

[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

April 1988 - No. 236

R. GENE CLARK, *EDITOR*
CHARLES B. LEWIS, *ASSISTANT EDITOR*

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To Our Readers

* * *

It was twenty years ago in April 1968 that **Payne Kibbe** and **George White** formed Nuexco with a business plan that presumed sustained growth in nuclear power. Nuexco's role was originally intended to be that of a banker, earning fees by arranging uranium loans between those with excess inventories and those that had short-term needs. The Nuexco Exchange Value was developed as a basis for settling these loans when the amount of uranium returned differed from the amount borrowed. Over time, as the nuclear industry grew and changed, Nuexco also evolved and took on roles and activities that were quite different and far more complex than those its founders had initially anticipated. Payne died in 1983, and George is now retired, living in Pebble Beach, California, but Nuexco has continued to grow.

That growth is, in large measure, a reflection of the people associated with the firm. One common thread within Nuexco has been the continuity of its personnel. **Bob Wolcott's** tenure as a shareholder and a director dates back to 1968; he later became Chief Executive. **Harold (Lindy) Lindberg** became the first Nuexco representative in 1970, and today, at age 82, remains a valuable daily contributor. Many other current employees, consultants, and representatives also have long service with the firm: **George White, Jr.**, the longest-term employee, has been with the company since 1971; **Kathie Kuziel** and **Don Ebright** since 1974; **Wayne Fowler** since 1975; **Jim Vaughan** since 1976; **Wes Miller** since 1977; **Edward Bee**, **Katie Bowen**, **Chris von Christierson**, and **Kazy Yokota** since 1978; **Bob Alexander**, **Don Radcliffe** and **Bryan Webster** since 1982; and **Chris Guitton**, **Earl Hoellen**, **Jim Lightner** and **Jim Stewart** since 1983. Nuexco's owner, **Oren Benton**, was first involved with Nuexco more than ten years ago, as a client with the Energy Fuels organization. Oren subsequently became a Nuexco director and shareholder in 1983, after his Energy Fuels association had ended.

Equally important to Nuexco's growth and success has been its ability to adjust to a changing market environment. The company's move to Denver brought with it new personnel, talents and disciplines that have allowed for a continuation of the pattern of adjustments to market changes first begun by George and Payne. Even though commercial techniques have evolved and become more sophisticated, Nuexco still deals with excess inventories and unfilled needs, the very problems that led to its formation twenty years ago.

While proud that it has not only survived but demonstrated an ability to grow in a difficult and competitive environment, Nuexco is also keenly aware that its success would not have been possible without the support and demonstrated confidence of its many clients and friends throughout the world.

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March 31, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$15.90**/lb. U_3O_8	5,960[2]	2,515[2]
US Premium	**$0.15**		
UF₆ VALUE	**$45.50**/kg U as UF_6	5,960[2]	2,515[2]
US Premium	**$0.50**		
CONVERSION VALUE	**$1.80**/lb. U as UF_6	150	750
SWU VALUE **0.30 tails assay**	**$70**/SWU	305	220
LOAN RATE	**3.5%**/annum	7,600	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	16.55	3.1	24	4

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers.
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

[2] For either uranium concentrates or uranium hexafluoride.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of March 31, 1988)

The **Exchange Value** is **\$15.90** per pound U_3O_8, down \$0.25 since last month. US-origin U_3O_8 is commanding a **premium** (relative to the Exchange Value) of **\$0.15** per pound U_3O_8 (down \$0.35). .

Active supply of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **5,960,000** pounds U_3O_8 equivalent, down 680,000 pounds since last month. The corresponding figure for **active demand** is **2,515,000** pounds, up 15,000 pounds. The spot and near-term supply-demand ratio is 2.4, down from 2.7 at the end of February.

The *Current Market Data* section of this Report lists twelve natural uranium sales, totaling approximately 12 million pounds U_3O_8 equivalent. Six of those involved near-term delivery and met the criteria for inclusion in the Transaction Value calculation. All of the transactions involved concentrates.

The **Transaction Value** is **\$16.55** per pound U_3O_8, down \$0.10 since last month. The calculation extends over a 4-month period and includes 24 transactions involving 3.1 million pounds equivalent U_3O_8.

The **UF_6 Value** is **\$45.50** per kilogram U in UF_6, down \$0.50. The premium for US-origin UF_6 is **\$0.50** per kilogram U (down \$0.75). No transactions involving UF_6 are reported.

The **Conversion Value** is **\$1.80** per pound U as UF_6, unchanged since last month. Active supply of secondary market conversion services totals 150,000 pounds U as UF_6. Active demand totals 750,000 pounds U as UF_6. One secondary market conversion transaction is reported.

The **Loan Rate** is **3.5 percent** per annum, unchanged since last month. No loan transactions are reported.

* * *

The **Exchange Value** declined \$0.25, to \$15.90 per pound U_3O_8 this month. The U_3O_8 market showed some renewed activity in March, and the combination of aggressive sellers' offers and limited, largely discretionary demand caused downward pressure on prices. Six spot or near-term transactions are reported this month, totaling over 600,000 pounds U_3O_8 equivalent; all of these sales involved US-origin concentrates. In addition, six long-term transactions are reported, totaling over 12 million pounds U_3O_8 equivalent, all involving concentrates.

Spot market demand for concentrates consisted primarily of US utilities considering discretionary purchases, and during the month at least four US utilities purchased US-origin material. Near the end of the month, several US producers had lowered prices to near the \$16.00 level as they competed to sell a significant quantity of material to one US utility.

This competition caused the **Premium** (relative to the Exchange Value) for US-origin U_3O_8 to drop in March, declining \$0.35 to \$0.15. The price for US-origin concentrates has now dropped to the point where most buyers in the USA will purchase US-origin material in preference to non-US-origin. In such a situation, sellers of non-US-origin material could be forced into another round of price cuts if they wish to compete in the US market, at least until the uncertainties overhanging the market for US-origin material are resolved.

On March 30, the US Senate passed the Uranium Revitalization, Tailings Reclamation and Enrichment Act (S. 1846) by a margin of 62-28. The bill includes an amendment mandating certain restrictions on imports of non-US-origin uranium. Although the bill's eventual passage by the House of Representatives and its signature into law by President Reagan remain questionable, the Senate's passage did revive some US producers' hopes that uranium import restrictions would eventually be imposed. The bill was passed too late in March, however, to affect the month's transactions; any impact on US producers' offering prices remains to be seen.

Despite the progress of the uranium revitalization bill, the market for US-origin concentrates is likely to reflect the current state of uncertainty until at least June, when the Supreme Court is expected to issue its ruling in the US Producers vs. DOE lawsuit. The US-Canada Free Trade Agreement's (FTA) eventual implementation also remains in doubt, as various special interest groups, members of Congress, and the Administration seek a workable package of implementing legislation that will be acceptable to all parties on the US side. Canadian support of the FTA may decline in the event the uranium legislation is passed into law. Technically, the FTA specifies that Canadian uranium be exempt from restrictions under Section 161(v) of the Atomic Energy Act (the basis of the producers' lawsuit) but says nothing about restrictions based on any other law (such as the uranium legislation).

The **UF_6 Value** declined \$0.50 to \$45.50 per kg U as UF_6 during March. The market for natural UF_6 was unusually

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dormant during the month, and no transactions are reported. At the end of March, one US utility and one European utility were interested in purchasing natural UF_6, and several other potential buyers had expressed interest in or were evaluating offers for enriched uranium, although none had specified US-origin. Active supply of UF_6 is relatively weak, and little US-origin material is available for sale. However, the very limited demand for UF_6 at present has contributed to the downward pressure on prices.

The **Premium** (relative to the UF_6 Value) for US-origin UF_6 declined $0.75 to $0.50 per kg U as UF_6. Since relatively little US-origin UF_6 is available for sale, compared to the level of U_3O_8, and demand for US-origin also is very weak, prices could be vulnerable to large blocks of demand that may appear in the market. In such a market, small quantities of material might be obtained at prices below the UF_6 Value, but larger lots are likely to strain the available supply, which could lead to buyers paying somewhat higher prices.

* * *

The **Loan Rate** remained unchanged this month, at 3.5 percent per annum. Loan supply remains large, but no firm demand exists at the present time. No loan transactions are reported this month.

* * *

The **Conversion Value** is unchanged at $1.80 per pound U as UF_6. One US utility currently is evaluating offers for secondary market conversion, but this demand is largely discretionary. One secondary market conversion transaction is reported this month, at a price slightly above this month's Conversion Value; this transaction reflects the higher prices paid in Europe for conversion services, compared to those in North America.

ENRICHED URANIUM AND SWU

The **SWU Value** is $70 per SWU, down $3 since last month as a result of competition for a few sales opportunities. Most of the near-term SWU demand comes from three utilities, all seeking SWU contained in enriched uranium. One of those buyers is expected to buy a significant quantity within the next two months, and the others are interested in much smaller quantities. Because most potential SWU buyers presently are interested in enriched uranium, considerable competition by sellers offering material in that form has added downward pressure on SWU prices. No SWU transactions are reported this month.

* * *

USEC Contract Terminations

April 1, 1988 was the deadline for DOE customers that wanted to reduce or terminate their commitments under the US Enrichment Contract (USEC) to less than 70 percent of their reactor requirements without penalty for the DOE Fiscal Years 1996 through 1998.

While the USEC normally requires 10-years notification for termination without penalty, for the past three years DOE has extended the notification period. The reason given for the extension was to allow DOE customers to postpone their decision on further contracting under the USEC until the issues of the uranium producer's lawsuit, the TVA demand charges, and recovery of the enrichment enterprise's prior costs were resolved.

The real reason behind the extension could have been DOE's desire not to officially recognize any loss of future business. DOE's pricing policy requires it to recover projected costs for the next ten years, based on projected sales; as long as the USEC customers did not formally terminate, they could be included in the sales projections. However, once termination notices had been received, the smaller customer base probably would require DOE to raise SWU prices, an unattractive option at a time when it perceived intense competition from foreign suppliers.

This year, DOE announced its intention not to extend the notification period, thus requiring its customers to make a decision on DOE SWU supply for FY 1996-98. While DOE did not disclose the reasons behind its decision, one of the major factors was the weakness of the US dollar, which has lost much of its value against the currencies of the European SWU suppliers in the last three years. While some of the European suppliers' costs are dollar-based, overall, those suppliers are not nearly as cost-competitive as they were, reducing their ability to aggressively compete for DOE's customers.

DOE has insisted that loyal customers will get a better deal than those who terminate and then try to contract with DOE later. DOE's detractors have asserted that in 1984, DOE also promised better treatment to those who signed

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up for the USEC, and later offered more favorable terms to the holdouts. To those who argued that it was not necessary to contract ten years in advance in an industry which would be characterized by oversupply, DOE threatened to shut down another enrichment plant if a significant fraction of their customers declined to sign. In addition, DOE's foreign competition did not mount an effective campaign to encourage defection from DOE contracts until very recently, when Urenco apparently overcame a reluctance to contract far into the future and began making offers to US utilities for the late 1990s. SWU from the USSR were also offered, but most US utilities currently are unwilling to contract with the USSR.

Nuexco's information to date indicates that DOE's approach may have succeeded. In the USA, DOE had about 42 customers with USEC contracts, representing a potential demand of approximately 10 million SWU per year in FY1996. It appears that six of these customers have terminated all of their FY1996-98 commitments and three other customers have reduced their commitments to below the 70-percent level. As shown in Table 1, these terminations represent a total of 2.3 million SWU per year, or slightly above 20 percent of the US market for SWU. Another 20 percent of the US market, representing the 30 percent of commitments that the remaining USEC contract holders can cancel with only five years notice, remains effectively uncommitted for FY1996 to FY1998. Approximately 10 percent of the US market did not sign the USEC, leaving DOE with firm commitments for 50 percent of the US demand for these years.

Considering that none of the US utilities which terminated their USEC contracts have made firm commitments to other suppliers, and several of those which terminated have expressed a desire to return to DOE under certain conditions, it would appear that DOE has been successful in maintaining its own market niche. Much of its success can be attributed to DOE's own efforts, as it appeared that in the case of at least another six utilities, whose fuel managers recommended termination to their management, those managers were overruled after intense, high-level DOE lobbying. It remains to be seen what impact the terminations will have on DOE's pricing calculations, but the relative impact of the terminations is small compared to the magnitude of some congressional demands for cost recovery.

The outcome for DOE in Europe was not as successful, but that could be expected considering the bias toward European sources of supply. DOE started with European USEC customers representing a little more than 1 million SWU per year in the mid-1990s, or slightly less than 10 percent of the potential demand of about 13 million SWU. Nuexco believes DOE received one total and two partial terminations, representing about 30 percent of its previous European commitments. The terminated commitments are likely to be met by Western European and Soviet suppliers.

In the Far East, DOE reportedly did not receive any terminations as of April 1. The majority of the demand in the Far East comes from Japan, where the special circumstances of the US-Japan nuclear cooperation agreement may have led to an extension of the notification period.

Table 1

RESULTS OF DOE USEC CUSTOMER TERMINATION NOTICES FOR FISCAL YEARS 1996 to 1998
(Millions of SWU)

Region	USA	Europe	Far East
Projected Total Annual Demand	10.5	13	6
Annual Demand under USEC Prior to 4/1/88	9.6	1.1	5
Annual Demand Terminated on 4/1/88	2.3	0.3	—

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (Mar 31, 1988)	Last Month (Feb 29, 1988)	12 Months Ago (Mar 31, 1987)	This Month (Mar 31, 1988)	Last Month (Feb 29, 1988)	12 Months Ago (Mar 31, 1987)
Australia (dollar)	21.51	22.45	24.16	55.91	58.35	62.82
Belgium (comm. franc)	555.56	570.07	633.86	1,444	1,482	1,648
Canada (dollar)	19.64	20.40	22.22	51.07	53.03	57.77
EEC (ecu)	12.80	13.20	14.80	33.27	34.33	38.47
Finland (markka)	63.83	65.95	75.35	165.94	171.44	195.91
France (franc)	89.53	92.29	101.86	232.75	239.92	264.81
FRG (mark)	26.40	27.26	30.54	68.64	70.87	79.39
Italy (lira)	19,557	20,092	21,862	50,844	52,235	56,837
Japan (yen)	1,984	2,073	2,484	5,157	5,389	6,457
Netherlands (guilder)	29.66	30.60	34.57	77.12	79.56	89.87
South Africa (rand)	33.82	33.51	34.07	87.93	87.11	88.57
Spain (peseta)	1,770	1,841	2,157	4,603	4,786	5,607
Sweden (krona)	93.92	96.65	107.32	244.16	251.26	279.02
Switzerland (franc)	21.79	22.42	25.48	56.65	58.30	66.24
UK (pound)	8.45	9.11	10.58	21.97	23.68	27.49
US (dollar)	15.90	16.15	17.00	41.34	41.99	44.20

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (Mar 31, 1988)	Last Month (Feb 29, 1988)	12 Months Ago (Mar 31, 1987)	This Month (Mar 31, 1988)	Last Month (Feb 29, 1988)	12 Months Ago (Mar 31, 1987)
Australia (dollar)	22.39	23.14	24.09	58.20	60.16	62.64
Belgium (comm. franc)	578.27	587.72	631.99	1,503	1,528	1,643
Canada (dollar)	20.45	21.03	22.15	53.16	54.67	57.60
EEC (ecu)	13.32	13.61	14.76	34.63	35.39	38.36
Finland (markka)	66.44	67.99	75.13	172.73	176.75	195.33
France (franc)	93.19	95.14	101.56	242.27	247.35	264.03
FRG (mark)	27.48	28.11	30.45	71.45	73.07	79.16
Italy (lira)	20,357	20,714	21,798	52,923	53,852	56,670
Japan (yen)	2,065	2,137	2,476	5,368	5,556	6,438
Netherlands (guilder)	30.88	31.55	34.47	80.27	82.03	89.60
South Africa (rand)	35.21	34.54	33.97	91.53	89.81	88.31
Spain (peseta)	1,843	1,898	2,150	4,791	4,935	5,590
Sweden (krona)	97.76	99.64	107.01	254.14	259.04	278.20
Switzerland (franc)	22.68	23.12	25.40	58.96	60.10	66.05
UK (pound)	8.80	9.39	10.54	22.87	24.41	27.41
US (dollar)	16.55	16.65	16.95	43.03	43.29	44.07

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb U as UF_6 This Month (Mar 31, 1988)	per lb U as UF_6 Last Month (Feb 29, 1988)	per lb U as UF_6 12 Months Ago (Mar 31, 1987)	per kg U as UF_6 This Month (Mar 31, 1988)	per kg U as UF_6 Last Month (Feb 29, 1988)	per kg U as UF_6 12 Months Ago (Mar 31, 1987)
Australia (dollar)	2.43	2.50	2.56	5.37	5.52	5.64
Belgium (comm. franc)	62.89	63.54	67.11	138.66	140.07	147.96
Canada (dollar)	2.22	2.27	2.35	4.90	5.01	5.19
EEC (ecu)	1.45	1.47	1.57	3.19	3.24	3.45
Finland (markka)	7.23	7.35	7.98	15.93	16.20	17.59
France (franc)	10.14	10.29	10.78	22.34	22.68	23.78
FRG (mark)	2.99	3.04	3.23	6.59	6.70	7.13
Italy (lira)	2,214	2,239	2,315	4,881	4,937	5,103
Japan (yen)	224.55	231.04	262.97	495.05	509.35	579.74
Netherlands (guilder)	3.36	3.41	3.66	7.40	7.52	8.07
South Africa (rand)	3.83	3.73	3.61	8.44	8.23	7.95
Spain (peseta)	200.42	205.20	228.34	441.86	452.38	503.40
Sweden (krona)	10.63	10.77	11.36	23.44	23.75	25.05
Switzerland (franc)	2.47	2.50	2.70	5.44	5.51	5.95
UK (pound)	.96	1.02	1.12	2.11	2.24	2.47
US (dollar)	1.80	1.80	1.80	3.97	3.97	3.97

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value at 0.30% tails assay (Mar 31, 1988)	UF_6 Value per kg U as UF_6 This Month (Mar 31, 1988)	UF_6 Value per kg U as UF_6 Last Month (Feb 29, 1988)
Australia (dollar)	94.68	61.54	63.93
Belgium (comm. franc)	2,446	1,590	1,624
Canada (dollar)	86.48	56.21	58.09
EEC (ecu)	56.34	36.62	37.61
Finland (markka)	281.01	182.65	187.83
France (franc)	394.14	256.19	262.85
FRG (mark)	116.24	75.55	77.65
Italy (lira)	86,101	55,966	57,228
Japan (yen)	8,733	5,676	5,904
Netherlands (guilder)	130.60	84.88	87.17
South Africa (rand)	148.90	96.78	95.439
Spain (peseta)	7,794	5,066	5,244
Sweden (krona)	413.47	268.75	275.28
Switzerland (franc)	95.93	62.35	63.87
UK (pound)	37.20	24.18	25.94
US (dollar)	70.00	45.50	46.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4268	1989-1993	1,001 - 1,500	see Remarks	Producer	Utility	Price related to market, with ceiling
4269	1991-1995	301 - 600	R[3]	Producer	Utility	US-Origin
4272	1990-1994	601 - 1,000	see Remarks	Producer	Utility	Price related to market, with ceiling
4273	1988-1991	3,001 - 5,000	see Remarks	Producer	Utility	Price related to market, with ceiling (late 1987 transaction)
4278	1988	101 - 300	98-102	Producer	R[3]	US-Origin
4279	1988-1997	1,501 - 3,000	R[3]	Producer	Utility	
4281	1988	50 - 100	98-102	Intermediary	Utility	US-Origin
4282	1988	less than 50	98-102	Intermediary	Utility	US-Origin
4283	1989	50 - 100	98-102	Intermediary	Utility	US-Origin
4286	1988	50 - 100	98-102	Producer	Utility	US-Origin
4287	1990-1994	1,501 - 3,000	see Remarks	Producer	Utility	Price related to market
4288	1988	101 - 300	98-102	Producer	Utility	US-Origin

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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CURRENT MARKET DATA

Conversion Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks
4284	1988	101 - 300	112-117	Intermediary	Utility	

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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URANIUM SUPPLY
(March 31, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale: ACTIVE			
87-1002	270	—	
87-1005	200	400 per year	1988-95
87-1023	500	500 per year	1988-90
87-1061*	700	200 per year	U_3O_8 or UF_6, 1988 on
87-1123	400	—	
87-1130*	550	—	
87-1141	500	200 per year	1989-92
87-1152	200	—	
87-1159	60	—	
87-1161	1,000	1,000 per year	
88-1000*	160	—	U_3O_8 or UF_6
88-1001	200	—	1988
88-1026*	250	—	1988
88-1033A*	130	—	1988, UF_6
88-1036	100	—	1988
88-1041*	740	—	UF_6
87-1001	—	400 per year	1989 on
TOTAL:	5,960		
INACTIVE			
87-1053	100	400 per year	1989 on
87-1135*	260	—	UF_6
87-1136*	260	—	UF_6
87-1156*	825	—	
87-1019	—	600 per year	1988-91
TOTAL:	1,445		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1017.

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URANIUM DEMAND
(March 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
87-1040	700	300	1989, UF_6
87-1121	650	650 per year	1988-96
88-1013A	150	—	1988, UF_6e
88-1017A	750	—	1988, UF_6e
88-1035A	40	—	1988, UF_6e
88-1045*	225	525	1989-90, UF_6
87-1013	—	1,200 per year	1990-95
87-1021	—	200 per year	1992 on
87-1134	—	260	1989
87-1172	—	500 per year	1990 on
88-1044	—	2,400	1991-95
88-1056*	—	500 per year	1989-93, U_3O_8 or UF_6
TOTAL:	2,515		
INACTIVE			
87-1154A	80	—	1988, UF_6e
87-1163	160	—	1989-92
88-1014	190	—	1988
87-1166	—	650	1989, UF_6
TOTAL:	430		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1108, 87-1146, 88-1022, 88-1024.

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LOAN SUPPLY AND DEMAND
(March 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan: **ACTIVE**			
87-1012	2,000	—	
87-1071	1,000	—	UF_6
87-1157	4,000	—	
88-1057*	600	—	
TOTAL:	7,600		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
TOTAL:	2,000		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 87-1064, 87-1167.

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(March 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
88-1004	150	—	
TOTAL:	150		
INACTIVE			
87-1008	750	750	
TOTAL:	750		
Inquiries to Purchase:			
ACTIVE			
88-1034*	750	—	
TOTAL:	750		
INACTIVE			
88-1021	65	—	
TOTAL:	65		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 88-1020.

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SWU SUPPLY AND DEMAND
(March 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale: **ACTIVE**			
87-1058	90	—	1988
87-1068*	200	—	1988,UF_6e
88-1033B	15	—	1988
TOTAL:	305		
INACTIVE			
87-1004	55	—	1988
87-1128	300	—	1988
TOTAL:	355		
Inquiries to Purchase: **ACTIVE**			
88-1017B	160	—	1988, UF_6e
88-1013B	40	—	1988,UF_6e
88-1035B	20	—	1988, UF_6e
88-1050*	—	45	1989
TOTAL:	220		
INACTIVE			
87-1065	150	—	1988
87-1154B	20	—	1988, UF_6e
87-1171	130	—	1988
TOTAL:	300		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: None.

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URANIUM PRODUCTION IN FRANCE

Introduction

France was one of the first nations to assume a leadership role in the development of nuclear power generation. The French Commission for Atomic Energy (Commissariat a l'Energie Atomique - CEA) was formed on October 18, 1945 to establish and regulate national nuclear policy, and the French program developed rapidly to include the complete nuclear fuel cycle. The CEA has since maintained an aggressive and uninterrupted program, leading the country to the forefront of nuclear technology. That the program has been a success is demonstrated by the fact that nuclear reactors currently generate over 70 percent of the electrical power in France, up from about 10 percent in 1973. There are 53 nuclear power plants now operating in France, with a combined gross power capacity of approximately 52,000 MWe.

France is fortunate to have significant uranium resources, which it has vigorously exploited. However, even those resources have proved insufficient to support France's growing nuclear program, and a combination of overseas uranium purchase contracts and equity investments in uranium production operations now supply the majority of France's uranium requirements. In fact, France has contractual or equity relationships with organizations in every major uranium-producing country, and is in the forefront of exploration activity both in established areas and in areas of new exploration. Virtually all uranium production in France now is handled by semi or fully government-owned companies, including Cogema.

Background

At the time the nuclear program was established, France had no known uranium resources. One of the CEA's most important concerns was to establish a uranium resource base sufficient to support the nuclear program, first, within France, and later, augmented by resources outside France. Thus, one of the CEA's earliest actions was to initiate uranium exploration throughout France in areas considered to be geologically favorable.

Exploration began in 1946 in the granitic rocks of the Massif Central region (Figure 1), where radioactive occurrences had been discovered during early exploration and mining of radium and associated minerals. Important discoveries at Forez in 1947 and Limousin in 1948 encouraged the rapid expansion of CEA's exploration effort. The CEA intensified its activities in the Massif Central region and other granitic complexes, including the Massif Armoricain, the Massif Vosges, and also to the sedimentary basins surrounding the Massifs, including the basins south of the Massif Central.

The CEA continued to make important discoveries throughout the early to mid-1950s and individual prospectors and private companies increasingly competed for exploration permits in France. The surge in activity resulted in new discoveries in Britanny, the Massif Central, and in Oligocene and Permian sediments. By the early 1960s, at least 70 uranium occurrences had been discovered in France. Generally, individual deposits are small, containing from about 100,000 to 2-3 million pounds U_3O_8; however, at least eight deposits are known to contain more than 10 million pounds U_3O_8.

Exploration activity decreased sharply during the period from 1963 to 1973, even though additional discoveries were made in the Massif Central region during the late 1960s. The world-wide energy crisis of 1973, however, again caused both the CEA and private companies to increase uranium exploration, both in France and in other countries. By 1976, the majority of exploration activity by the CEA and private French companies had shifted to uranium targets outside France, and the CEA was actively exploring in up to 13 foreign countries.

The more prominent private-sector companies included Pechiney Ugine Kuhlmann (PUK); Compagnie Miniere Dong-Trieu; Compagnie Francaise de Mokta (CFM, a subsidiary of Imetal); Compagnie Industrielle et Miniere (CIM, a subsidiary of Rhone Poulenc); and Total Compagnie Miniere (TCM). Two other organizations, Minatome Corp., and Elf-Aquitaine, both with almost an even split between government and private ownership, began exploring for uranium in 1975 and 1977 respectively. Thus far, only exclusively French-owned companies have participated in the French uranium industry.

Geologic Setting

The most prominent geologic feature in France is the Moldanubian Zone that extends east to west across central France. The zone is composed primarily of a granitic core with associated schists and gneisses formed by metamorphism of intruded sediments. The Massif Central constitutes the principal structural feature, forming the central highlands of France. Moldanubian Zone rocks are considered to be related to those of the Hercynian Orogeny, which have been age dated at 350 to 400 million years.

Although Moldanubian Zone granites make up the principal uranium area of France, this area also includes structural basins containing Permian sediments which are host to uranium mineralization. The deposits at Cerilly and St. Pierre du Cantal are examples of basins directly associated with the Massif Central. The southern basins, including the important deposits in the Lodeve district, are more closely associated with the Cevenno-Vendean Zone, containing a thick sequence of Permian and Mesozoic sediments which developed along the southeastern periphery of the Moldanubian Zone.

In general, the basins formed during several stages of regional tectonics, the last of which occurred during the Alpine Orogeny of Late Cretaceous and Early Tertiary periods, estimated at 130 to 60 million years ago. Faulting and brecciation influenced the sedimentary sequence in Permian basins, and the mineral-rich solutions that formed during the weathering of volcanics and granites of the Moldanubian Zone introduced uranium mineralization into the area.

Uranium is also found in host sediments, consisting of highly carbonaceous sand/clay units of Paleogene and Eocene age, formed from the weathering of older rocks. Additional deposits have been discovered in the Aquitaine Basin which currently is being explored in considerable detail. The Paris Basin, and other basins influenced by tectonic events of the Moldanubian Zone, offer potential for new uranium deposits, and exploration is continuing in those areas. Uranium-bearing sediments also have been located in basins of the Lower Tertiary system, primarily Paleogene sediments. These sedimentary deposits are, for the most part, outside the tectonic influence of the Moldanubian Zone. The undeveloped Coutras and Trevills deposits are in this category.

Figure 1 shows the geographic location of uranium processing plants with relationship to the regional geology of France. Table 3 lists the presently operating mines supplying ore to the plants, and mines closed due to depleted reserves or unfavorable economics.

Uranium Resources

Uranium resources typically are classified as Reasonably Assured Resources (RAR) and Estimated Additional Resources, Category I (EAR-I). RAR includes all resources occuring in known deposits and EAR refers to additional uranium that is expected to occur based on geologic evidence. Each resource base is categorized according to estimated cost of production, that is, costs below US$30 per pound, and costs from US$30 to $50 per pound. French resources, according to industry figures published in 1986, are listed in Table 2.

Table 2

URANIUM RESOURCES OF FRANCE, 1986*
(Millions of Pounds U_3O_8)

Reasonably Assured Resources (RAR)		**Estimated Additional Resources (EAR-I)**	
Recovery Cost Estimate — US$/Lb			
Up to $30	$30 to $50	Up to $30	$30 to $50
145.5	28.9	69.7	47.7
Total RAR = 174.4		Total EAR = 117.4	

*Adapted from *The French Uranium Mining Industry*, 1986, p. 57. Allowance for mining and processing losses are reflected in totals. Resource classification conforms with the publication *Uranium Resources, Production and Demand* (the Red Book), a joint report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency, 1986, pages 19-26.

Historically, discoveries of new uranium resources in France have stayed ahead of the exploitation rate. Overall, production has totaled approximately 132 million pounds U_3O_8 through 1986. Current annual production from all French uranium mines is about 8.5 million pounds U_3O_8 (3,200 MTU). Table 4 presents a summary of French uranium production for the period 1950 to 1986.

Uranium Deposits

Two rock types and two modes of occurrence characterize commercial-grade uranium mineralization in France — granitic vein-type deposits and layered sedimentary deposits.

Granitic deposits — The uranium deposits of greatest importance are associated with a metamorphic and granitic complex, referred to as the Moldanubian Zone. The mountainous highland region of the Massif Central contains the primary area of granitization and related metamorphic-phase rocks. Uranium occurs mainly in systems of veins and/or veinlets, largely confined to light-colored, course-grained and micaceous granites, along intersections of

Table 3

URANIUM MINES AND ORE PROCESSING FACILITIES IN FRANCE (Active and Inactive)

Site (District)	Operator	Start-up (year)	Nominal Capacity (1,000 lbs. U_3O_8/Yr)	Support Mines (Operating and Closed)
L'Ecarpiere (Vendee)	Cogema	1957	1,675	*Operating* — l'Ecarpiere, Chardon, Commanderie, Roussay, Pennaran *Closed* — Chapelle, Herbiers, Retail, Dorgissiere, Prat Merien, Bonote, Quistiave
Bessines (La Crouzille)	Cogema	1958	3,900	*Operating* — Montulat, Bellezane, Fraisse, Les Gorces, Peny, Fanay, Margnac, Coussat, Hyverneresse, Les Jalerys *Closed* — Brugeaud, Chanteloube, Augeres, Venachat, Bonnac, La Betoulle, Henriette, Bauzot, Faye, Les Brosses, Lombre
Le Cellier (Lozere)	Mokta (CFM)	1977	780	*Operating* — Le Cellier, Villeret, Les Pierres, Plantees, Bondons
Bernardan (Haute-Vienne)	Total (TCM)	1979	1,300	*Operating* — Le Bernardan, Piegut, Les Loges, Gouzon, Creuse, Correze, Aveyron *Closed* — Cote-Moreau, Masgrimaud
St. Martin Du Bosc (Lodeve)	Cogema	1981	2,300	*Operating* — Mas d'Alary, Mas Lavayre. Closed — Rabejac
Bois-Noirs (Forez)	Cogema	1954	1,250	*Closed* — Bois-Noirs, (1980, mine/mill dismantled)
St. Pierre (Cantal)	Total (TCM)	1978	860	*Operating* — La Ribiere, Bertholene. (Vat leach recovery process at each site). *Closed* — St. Pierre, Chaix Maillat, Les Ballaures

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Figure 1

URANIUM PRODUCTION CENTERS IN FRANCE

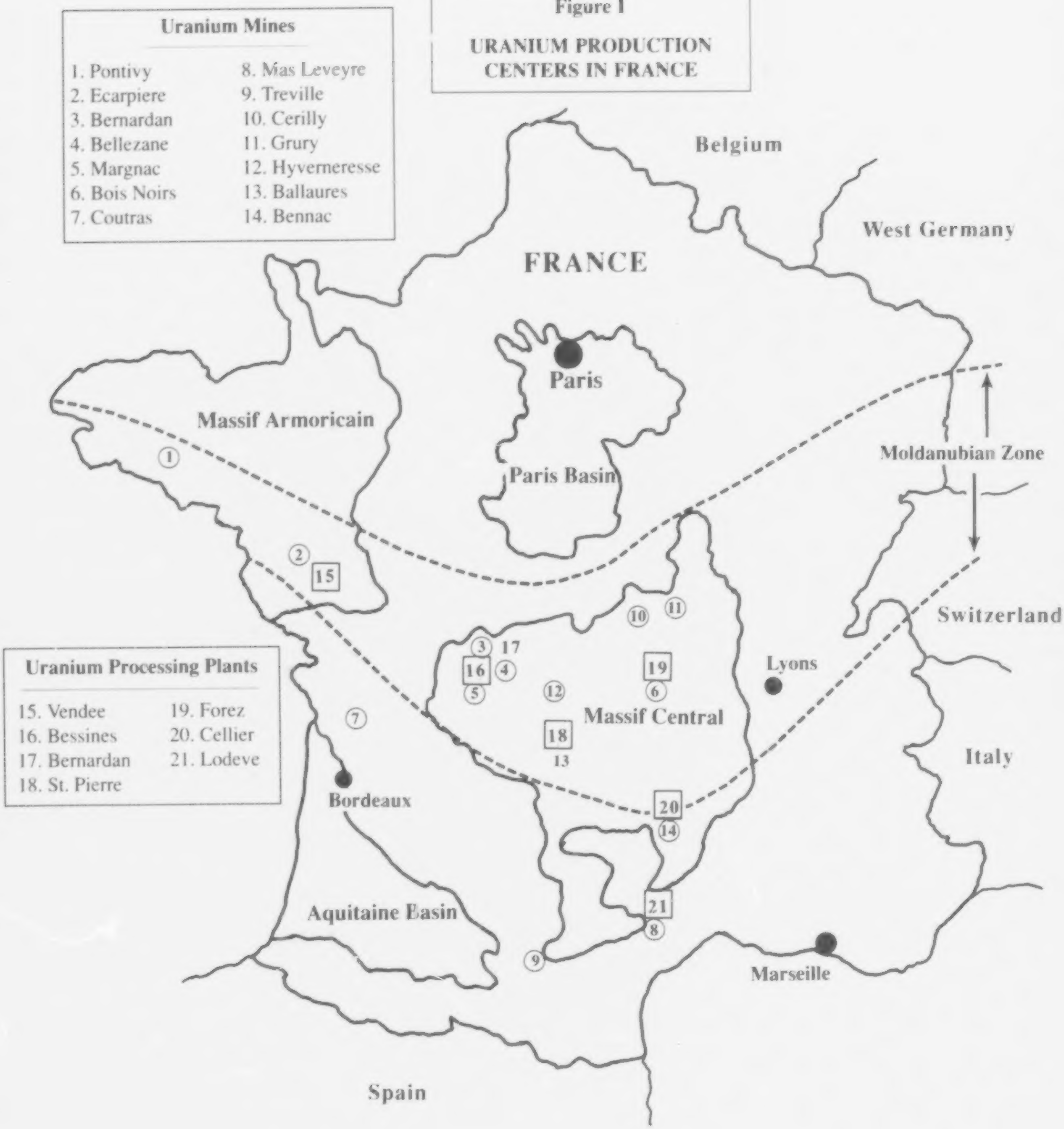
Uranium Mines
1. Pontivy
2. Ecarpiere
3. Bernardan
4. Bellezane
5. Margnac
6. Bois Noirs
7. Coutras
8. Mas Leveyre
9. Treville
10. Cerilly
11. Grury
12. Hyverneresse
13. Ballaures
14. Bennac
Uranium Processing Plants
15. Vendee
16. Bessines
17. Bernardan
18. St. Pierre
19. Forez
20. Cellier
21. Lodeve
Belgium
West Germany
FRANCE
Paris
Massif Armoricain
Paris Basin
Moldanubian Zone
Switzerland
Lyons
Massif Central
Italy
Bordeaux
Aquitaine Basin
Marseille
Spain
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫
13
⑭
15
16
17
18
19
20
21

Table 4

ANNUAL PRODUCTION OF URANIUM CONCENTRATES IN FRANCE, 1950 to 1986 *

Year	Uranium Production (1,000 lbs. U_3O_8)	Year	Uranium Production (1,000 lbs. U_3O_8)
1950	78	1969	3,055
1951	104	1971	3,247
1952	130	1971	3,260
1953	169	1972	3,588
1954	156	1973	3,939
1955	286	1974	4,180
1956	455	1975	4,472
1957	975	1976	4,786
1958	1,274	1977	5,452
1959	1,924	1978	5,675
1960	2,574	1979	6,154
1961	2,938	1980	6,739
1962	2,704	1981	6,642
1963	2,678	1982	7,467
1964	2,561	1983	8,506
1965	2,595	1984	8,236
1966	2,758	1985	8,301
1967	2,862	1986	8,452
1968	2,891		

**Source- CEA*

tectonic fault and fracture systems.

The most important mineralization zones are found in conjunction with fracture systems and intersecting vein systems. Vein-type orebodies tend to be generally horizontal in shape, and may extend for a thousand meters or more in linear dimension and be up to 20 or 30 meters in thickness. Veinlet-type orebodies are usually columnar in shape and may follow the downward extension of steeply dipping fault and fracture systems for several hundred meters, commonly in a host of altered micaceous granites. The width of such an ore body may vary from a few meters to 100 meters or more. A limited amount of ore also has been mined from similar structures in metamorphic rocks, mainly schists, adjacent to granitic contacts.

Much of the uranium mineralization came from widely dispersed uranium particles scattered throughout the granites being mobilized by hydrothermal action; later precipitation and concentration took place in the favorable environments of veins. Metamorphism and extensive alteration along faults and fracture systems contributed to the mineralizing process.

Of the primary ore minerals present in the granite environments, the principal one is pitchblende, with uraninite and coffinite also occurring in significant amounts. Brannerite and uranium titanate are usually present in minor amounts. The average uranium content of the vein-type linear deposits is about 0.16-percent U_3O_8, with local values often exceeding 0.50-percent. The uranium content of veinlet-type columnar deposits averages about 0.30-percent U_3O_8, but grades exceeding 2 percent are not uncommon. Approximately 49 percent of known uranium resources in France occur in the granitic environments, and about 3 percent is in metamorphic rocks.

Sedimentary Deposits — Uranium mineralization found in detrital sedimentary formations makes up the remaining 48 percent of known uranium in France. Important ore deposits have been discovered in continental sediments of Permian and Lower Tertiary ages. The largest deposits occur in Lower Permian rocks which have been preserved in structural basins that developed off the south slope of the Massif Central, in the Lodeve district (Figure 2).

Commercial uranium deposits in Permian sediments occur in the lower sedimentary series, consisting of a basal conglomerate which is in unconformable contact with older Paleozoic and Precambrian rocks. A stratified sequence of alternating beds consisting of fine-grained carbonaceous sandstones and mudstones, and bituminous dolomites and limestones, each averaging about one meter thick, overlies the conglomerate. The uranium deposits which formed into lenticular and roll-type bodies are found between two parallel fault systems. The orebodies are confined to channels within the stratified beds, especially in sandstones and/or siltstones containing a high percentage of carbonate and bituminous material. The principal uranium minerals present are pitchblende and coffinite, in association with molybdenum and iron sulfides.

The uranium in these sedimentary deposits probably came from mineral-rich solutions generated by widespread volcanogenics. The downward migration of the solutions and precipitation of uranium (and molybdenum) are controlled by contact with bituminous material in highly altered rock. The uranium content of these Permian deposits varies from about 0.10 to 0.30-percent U_3O_8; however, values above one percent occur in the fractured and brecciated zones, due to mineral remobilization along planes of weakness.

The deposits in the Cerilly district are hosted in basal Permian sandstones rich in organic matter. Uranium is concentrated in the upper portion of the zone and at the interface with overlying channel fill material. The important ore minerals are pitchblende and coffinite.

Uranium also has been discovered in Lower Tertiary sediments. The first such discovery was the St. Pierre deposit at Cantal, discovered in 1955, in which mineralization was found in a highly carbonaceous sandstone of Oligocene age. The sandstone was deposited in a small structural basin in which the basement rock is highly faulted granite. The fault systems served to channel the mineral-rich solutions into contact with the carbonaceous material, which acted as a reductant to precipitate the uranium in concentrations that averaged about 0.20-percent U_3O_8. In addition, uranium has been discovered in clayey sand and clay sedimentary facies of Eocene age in the Aquitaine and Limoges basins. In both cases, the significant minerals are pitchblende and coffinite.

Government Control of Uranium Production

The development and progression of uranium exploration and mining is an extension of the French government's energy and natural resource policies. Private companies originally were in direct competition with government-sponsored companies. However, the urgency of the national program and the overall success of projects initiated by private companies have led to a realignment of company affiliations and activities through mergers, acquisitions and consolidation of companies into semi-government-owned entities. This consolidation has allowed the government to create a stronger basis for nationalization of the uranium resource base, both domestic and foreign, through control of participating companies' technology, effort and assets. At present, there are only two remaining companies, operating primarily through wholly-owned subsidiaries, that maintain an active interest in uranium projects within France. Each has government affiliations, either directly or

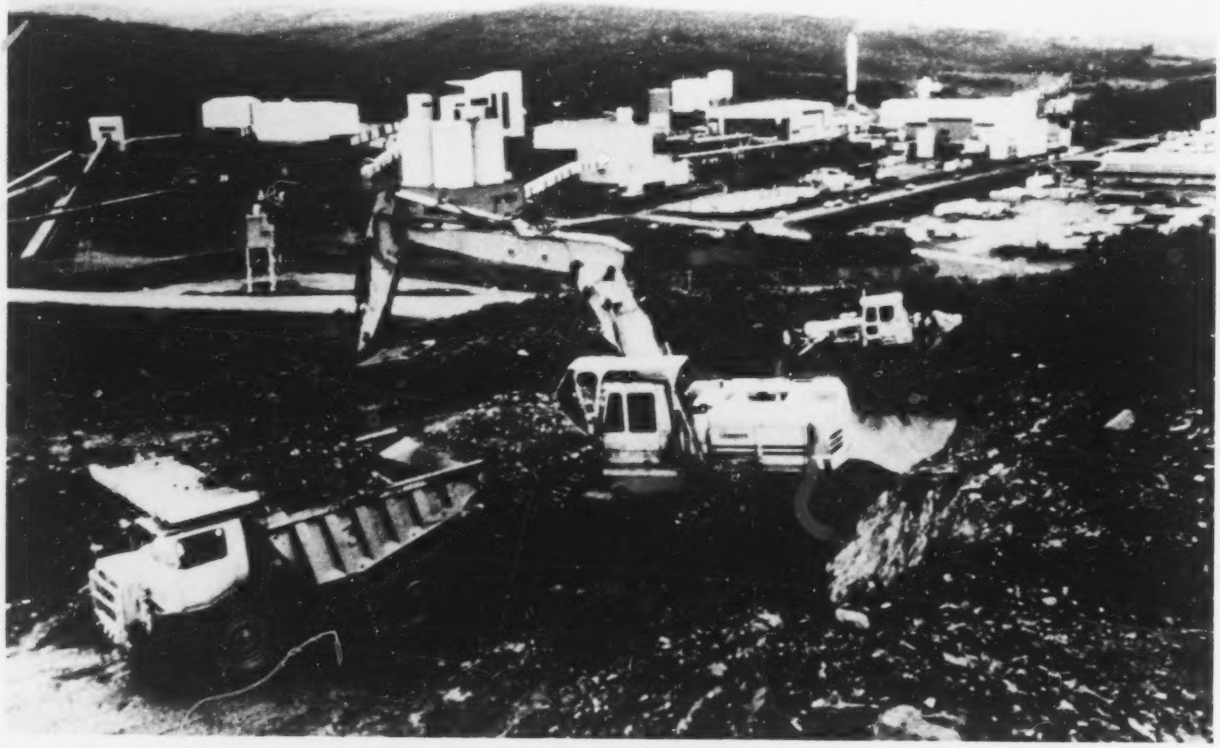

Figure 2. Mas Laveyre Open-pit Mine and Mill, Lodeve District, France.

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through an associate company, and each company has past ties with private industry.

The Role of Cogema

The transformation to government-controlled ownership and management began in 1976 when the CEA transferred all its exploration and mining responsibilities to a newly-formed and wholly-owned subsidiary, Cogema (Compagnie Generale des Matieres Nucleaires). Cogema assumed control of mining and milling operations in three districts of France, as well as exploration activities in France, Spain, Portugal, Zambia and Australia. In addition, the company became involved in exploration, mining and milling in Canada, Gabon, Niger and the USA. Cogema currently has controlling interest in about 30 companies involved with various aspects of the nuclear fuel cycle, including uranium exploration, mining and milling, conversion, enrichment, fuel fabrication, spent fuel reprocessing and related activities.

Cogema is the largest uranium producer in France, and its Natural Uranium Branch controls about 80 percent of France's Reasonably Assured Resources (approximately 160 million pounds U_3O_8). Cogema continues to explore for uranium in France, controlling about 60 percent of issued exploration permits, and the company operates mines and mills at the production centers of Herault, La Crouzille, and Vendee. It operates one mill directly; the two others are operated by Cogema's wholly-owned technical and engineering subsidiary Societe Industrielle des Minerais de l'Ouest (SIMO).

In June 1986, Cogema acquired a 100-percent interest in Compagnie Francaise De Mokta (CFM), one of the oldest mining companies in France. With this purchase, the last privately-owned uranium operations in France have come under government control. The acquisition also increased Cogema's uranium holdings in France, Australia and Canada. CFM continues as operator of two mines and a mill in the Lozere district of France, where it discovered uranium in 1956.

Cogema also gained full control over CFM subsidiary Societe des Mines d'Uranium du Centre (Smuc), as well as the 50-50 joint-venture formed in 1975 by CFM and the CEA to mine the Hyverneresse deposit located south of Aubusson. The CFM subsidiary Simura ceased mining in the Brittany district in early 1984 and is now inactive. Cogema also recently acquired undeveloped low-grade resources in the Correze, Gironde and Lozere areas from Compagnie Industrielle et Miniere (CIM), a Rhone Poulenc Group subsidiary. (CIM no longer has active uranium operations in France.)

Restructuring of Other Companies

The establishment of Cogema was followed by a government decree enacted on March 28, 1977 (Plan d'aide a la prospection de l'uranium), whereby privately-owned French companies became eligible to receive allowances covering 35 to 50 percent of costs related directly to uranium exploration, both in France and abroad. The plan was designed to assist high-risk exploration ventures, with the intent that the funds would be reimbursed if a commercial ore deposit were discovered and exploited. Most of the companies active in exploration took advantage of the plan, especially those with foreign ventures. Approximately 160-million francs were disbursed under the plan through 1981, the last year adequate funding was available.

Restructuring of company ownership patterns and activities began to accelerate in the late 1970s, and has continued with the uranium industry's prolonged recession. The most recent company to drop out of the uranium business because of the consolidation of French uranium interests is Societe Nationale Elf-Aquitaine Production (SNEAP). This company began exploring for uranium in France in 1977, later expanding its operations to the USA, Canada and Australia. In France, the company had an exploration permit in the Morvan St. Symphorien sector which covered the Ruaux mine site, where high-grade base metals were discovered and mined in the mid-1850s. The mine was reopened by the CEA for a short period following World War II, and a small amount of uranium was mined. SNEAP shared exploration permits with Electricite de France (EdF), through the utility's subsidiary, Societe Auxiliaire d'Energie (SAE). EdF recently has applied to the Ministry of Industry to transfer those permits to its sole ownership, in order to maintain them for possible future use.

At present, only one company, besides Cogema, remains active in uranium mining in France — Total Compagnie Miniere (TCM). TCM is a wholly-owned subsidiary of Total Compagnie Francaise Des Petroles, and has been active in uranium projects since 1954. In 1982, TCM expanded its uranium operations further by acquiring full ownership of Minatome (buying out Pechiney's 50-percent share), and Compagnie Miniere Dong-Trieu. It also has initiated exploration and mining projects in Australia, Britain, Canada, Ireland and the USA.

In France, two subsidiaries are active in exploration and mining:

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1. Compagnie Miniere Dong-Trieu (Dong-Trieu) discovered uranium ore in the Limousin/Bernardan district in the early 1970s. Mining and milling began in 1979, and annual production exceeds 1 million pounds U_3O_8 per year.

2. Societe Centrale de l'Uranium et des Minerais et Metaux Radioactifs (Scumra); since the processing plant at Saint-Pierre-du-Cantal closed in 1986, ore from mines in Creuse, Correze and Aveyron is shipped to the Dong-Trieu mill in the Bernardan district.

Exploration and Mining Permits

In France, even though the land is primarily under private ownership, the government claims ownership of all undeveloped minerals. The government controls all mineral exploration and mining activity under Article 7 of the French Mining Code. The Mining Code can be modified to cover technical and environmental conditions rélating to exploitation of all minerals, usually through the adoption of special decrees. Uranium exploration, mining and reclamationn are covered by implementation of these specific decrees. Every party to exploration must have a permit before initiating any such activity.

Exploration permits — There are two types of exploration permits. The first permit is relatively easy to obtain, but offers nonexclusive and limited exploration provisions. A company, or an individual, may obtain such a permit by contracting with a land owner or owners for exploration on a given tract of land, followed by filing a declaration with the local prefect stating intention to conduct specific exploration activities (drilling may be included), and giving proof of financial capability. The Ministry of Industry gives final approval. The time required to obtain this class of permit may vary from about four months to one year. Few companies seek such permits, for the obvious reason of nonexclusivity.

An exclusive Exploration Permit is the second type available. The applicant for this permit must follow the conditions and procedures specified in Decree 80-204, dated March 11, 1980. The application must include documents of understanding with the land owner or owners, a descriptive outline of proposed exploration methods and objectives, and proof that the applicant has the technical and financial capability to complete the project.

A permit can only be authorized after a series of public hearings, inquiries and reviews with participation by the local prefect, the Ministry of Industry and Research, the General Council of Mines, and finally the Conseil d'Etat, the highest administrative court in France. The permit is actually granted by issuance of a special decree from the Conseil d'Etat, which is signed by the Prime Minister and Minister of Industry. This procedure may require one to two years, although permits have been approved within eight months. The permit is valid for three years, with two options for renewal. All minerals may be included except hydrocarbons, coal and potash, which are produced under a nationalized program. Active exploration permits in France covered approximately 12,000 km^2 in early 1986.

Mining Permits — A company holding an Exploration Permit has priority for obtaining a permit to mine. There are two types of mining permits: an *exploitation permit* and a *concession*. Each type offers exclusive rights to mine within the limits of the permit area. The principal difference between the two types concerns the project's duration. An exploitation permit is valid for five years with two options to renew, offering at least fifteen years for property development and mining. The concession is valid for 50 years and can be renewed indefinitely, affording time advantages in the event development is delayed for any reason, such as unfavorable economic and marketing conditions. Usually, from one to two years is required to secure rights to mine.

Procedures for securing these mining permits closely parallel those for exploration permits. Before the Ministry of Industry will approve a permit, a company must undergo public hearings, inquiries and reviews of the exploitation program, including approval of a Specifications and Methods document which outlines operating procedures, plus filing an acceptable environmental impact statement. However, under the provisions of Decree 330, introduced in 1980, the Conseil d'Etat reserves final approval and issuance of permits. The decree sets the conditions for project exploration, exploitation and closure of mines. The local prefect and the Corps of Mining Engineers administer all permits.

Uranium Mining and Milling

Mining — The CEA began mining uranium at the Ruaux mine (located in the Morvan district) in 1946. This was the first mining project undertaken strictly for uranium. By 1957, exploration efforts by government agencies and private industry had resulted in the discovery of the seven major uranium districts in France; five in granitic host rocks and two in sedimentary formations. Mining began in

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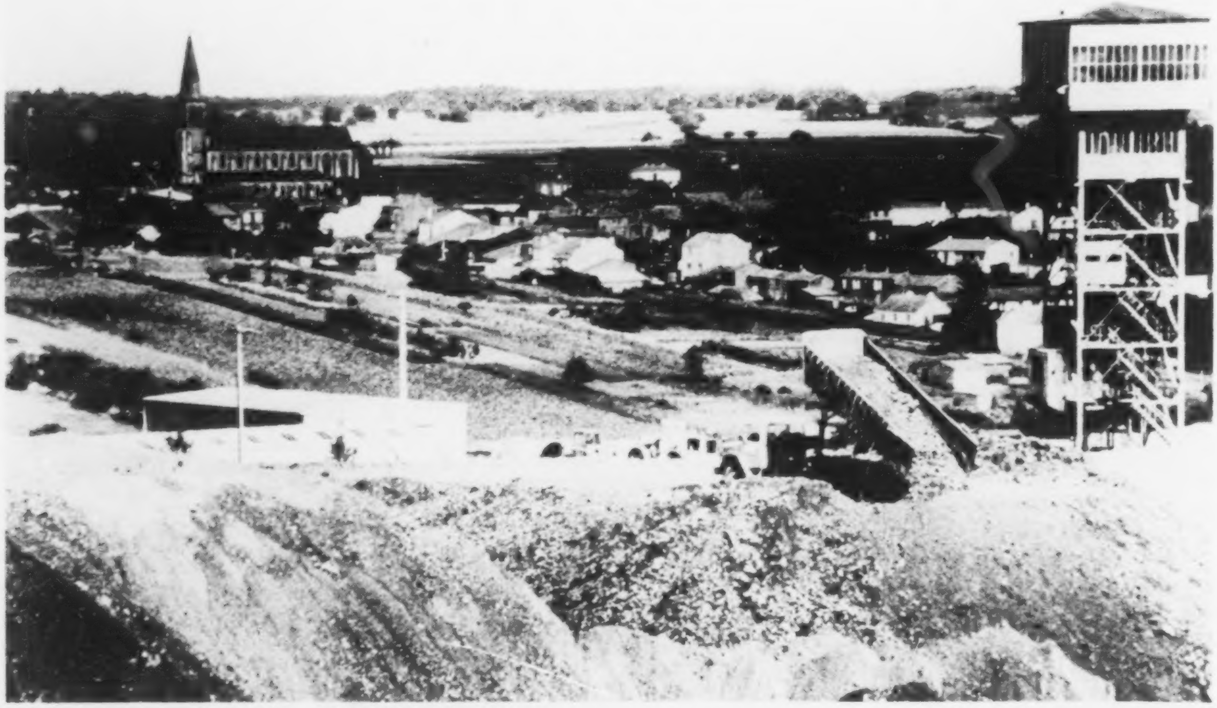

Figure 3. Commanderie Mine, Vendee District, France.

granitic rocks in the districts of Forez, La Crouzille, Vendee and Morvan in the early 1950s; milling of stockpiled ores began at Vendee (Figure 3) in 1957, and at La Crouzille in 1958. Mills were operating in six of the seven districts by 1981, when the Cogema mill at St. Martin du Bosc (Lodeve) began production. (The Forez mill was closed in 1980.)

Mining is carried out both by open pit and underground methods. The near-surface deposits and upper extensions of deeper deposits are mined by conventional open pit techniques. Several mines use radiometric sorters to aid mining, ore handling, stockpiling and milling. As mining is phased out, the site is reclaimed by partial backfilling of the pit, grading the upper pit walls to an acceptable slope, followed by revegetation and maintenance.

Deeper ore deposits are mined by sinking a vertical shaft and/or by driving a decline off the lower level of an open pit. Mining techniques have evolved through experience and are well adapted to the steeply dipping structural and host rock characteristics of each deposit. At some sites, mining efficiency is enhanced both by selective mining methods and by using radiometric sorters to evaluate the grade of ore being mined.

Underground mines generally use tire-mounted equipment (trackless) for greater flexibility in adapting to each ore occurrence. Using trackless equipment allows larger size machinery to be used, for greater efficiency throughout the mining process. The extensive use of wire-mesh and roof bolting for ground stabilization, rather than timber, adds to safety and operating efficiency.

Overhand mining is the most-used underground mining technique. The ore is mined from bottom to top in horizontal benches three to four meters in height; ore zone configuration or mine safety requirements determine the bench width. Ore removal is closely followed by backfilling the mined-out area with mill tailings to maintain stable ground

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conditions. The backfilled material becomes the working surface during the next horizontal pass as mining advances upward through the ore body.

In underhand mining, the operator removes steeply dipping ore from top to bottom along horizontal benches two to four meters thick and of an appropriate width. A reinforced concrete slab is then poured on the bench floor. Mining is resumed along the next lower level and the concrete slab then becomes the overhead support. After mining, each bench may be backfilled with mill tailings for stability.

At present, the depressed uranium market has forced some exploration and mining projects to slow down or shut down operations. Only high-grade mines in the lowest-cost category continue to operate; high-cost mines began closing in the early 1980s and in most cases, will remain closed until conditions improve. These high-cost projects are no longer competitive with the high-grade projects in Canada.

As a result of closing plants at Forez in 1980 and St. Pierre in 1986, plus the influence of recent company mergers, it became necessary to restructure which mines supplied ore to certain processing plants. For example, the ore from the Creuse, Correze and Aveyron mines is milled at Bernardan now that the mill at St. Pierre has closed.

Milling — During the late 1940s, the CEA initiated metallurgical testing on ores discovered at La Crouzille, Vendee, and Forez. The work was done in conjunction with private industry, including Pechiney-Ugine-Kuhlmann (PUK). From that joint effort, the CEA and PUK formed Societe Industrielle des Minerais de l'Ouest (SIMO) in 1955. SIMO built the first mill exclusively for processing domestic ores at St. Priest la Prugne (Forez district) in 1954. (Note: the processing plant built earlier by the CEA at Gueugnon in the Morvan Grury sector processed uranothorianite ore from Madagascar, and preconcentrates from the Forez district. It was closed in the early 1960s, before the mines in the Grury sector were put into production.) During the period through 1981, SIMO built four additional mills, and TCM and Dong Trieu each built one.

The first six mills use a sulfuric acid leach to liberate the uranium, followed by precipitation with ammonium or magnesium hydroxide to form ammonium diuranate or magnesium uranate. The former contains up to 75-percent U_3O_8; the latter contains not less than 70-percent U_3O_8. The seventh and newest mill, located at Lodeve, uses a mixture of sodium carbonate and bicarbonate to leach the uranium from the ore, primarily because of the calcium minerals and carbonaceous material associated with the uranium. The dissolved uranium is first precipitated by the addition of lime; final concentration to 70-percent U_3O_8 is accomplished with the addition of milk of magnesia, forming magnesium uranate.

Outlook

France is the second-largest consumer of uranium in the free world, after the USA, with annual consumption expected to increase from about 20 million pounds U_3O_8 in 1985 to almost 30 million pounds in the year 2000. A significant portion of this material will come from French participation in projects outside of France. Production from those sources currently equals, and will soon exceed, that taken from domestic production facilities. Many of those foreign projects, especially in Canada, have production costs lower than domestic projects.

Most domestic production is obtained from deposits of low to moderate ore grade, and which are not sufficiently large to achieve the economies of scale that characterize many of the foreign projects. Thus, domestic production will provide a decreasing share of French uranium requirements.

The domestic uranium industry has been effectively consolidated under government control, largely under Cogema. Given the relatively small size of French deposits, and the relatively high cost of producing uranium at those sites, whether the government will continue to keep all or even most of those production centers open in the future, much less develop new ones, is a matter of speculation.

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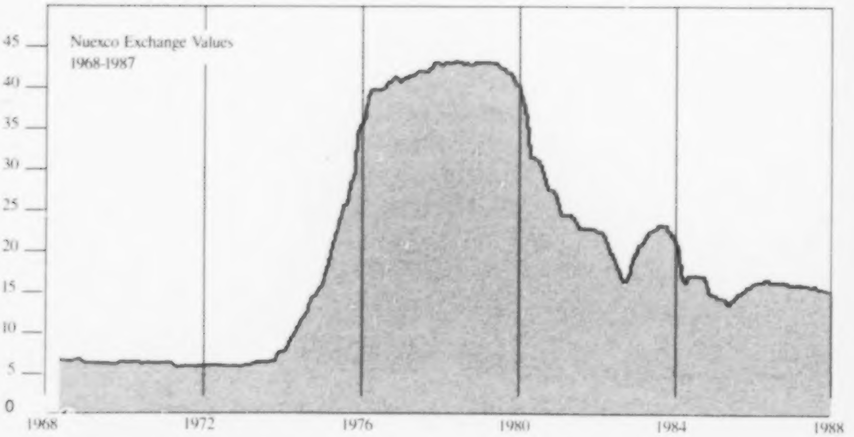
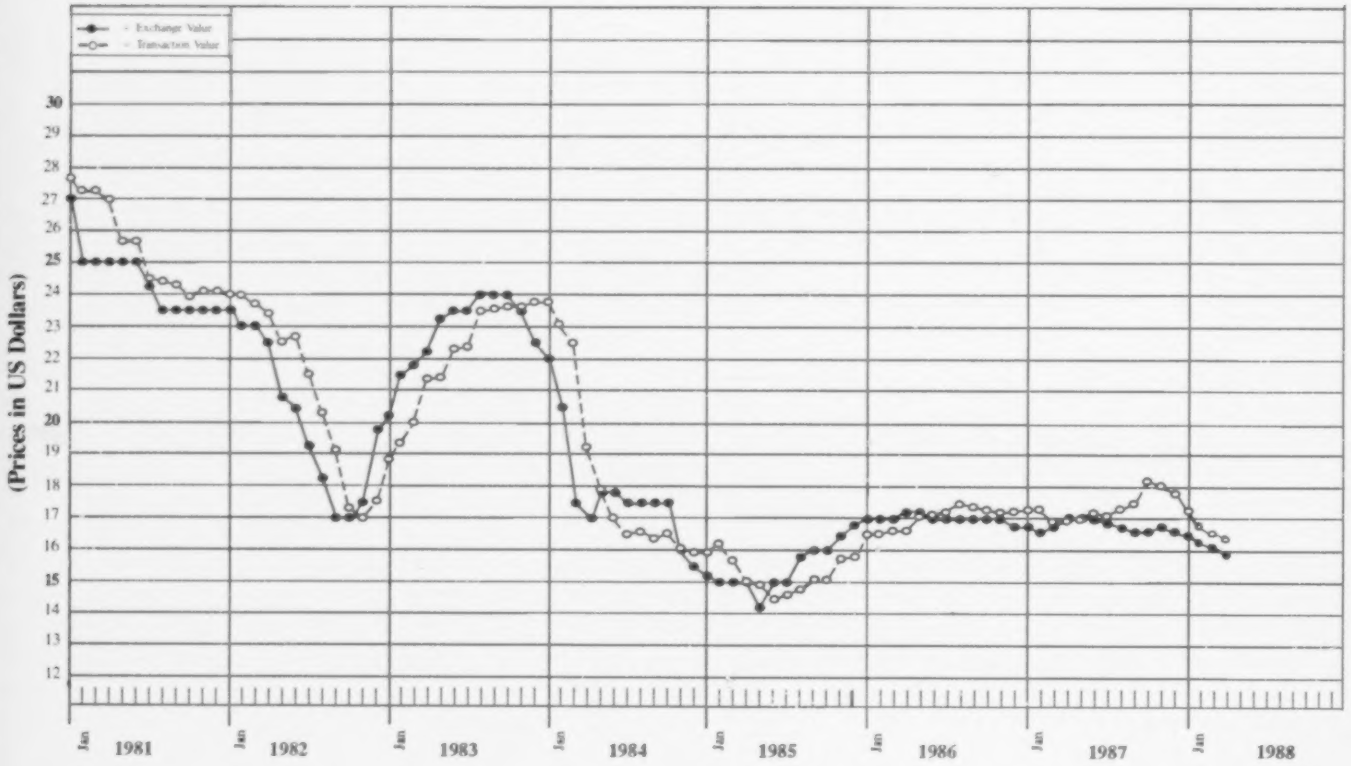
HISTORICAL MARKET DATA





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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	**15.90**									

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	**0.15**									

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	**16.55**									

HISTORICAL MARKET DATA

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	**1.80**									

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	**45.50**									

HISTORICAL US UF_6 PREMIUM (Relative to the UF_6 Value)

Determined as of the last day of the month indicated ($US/kg U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	**0.50**									

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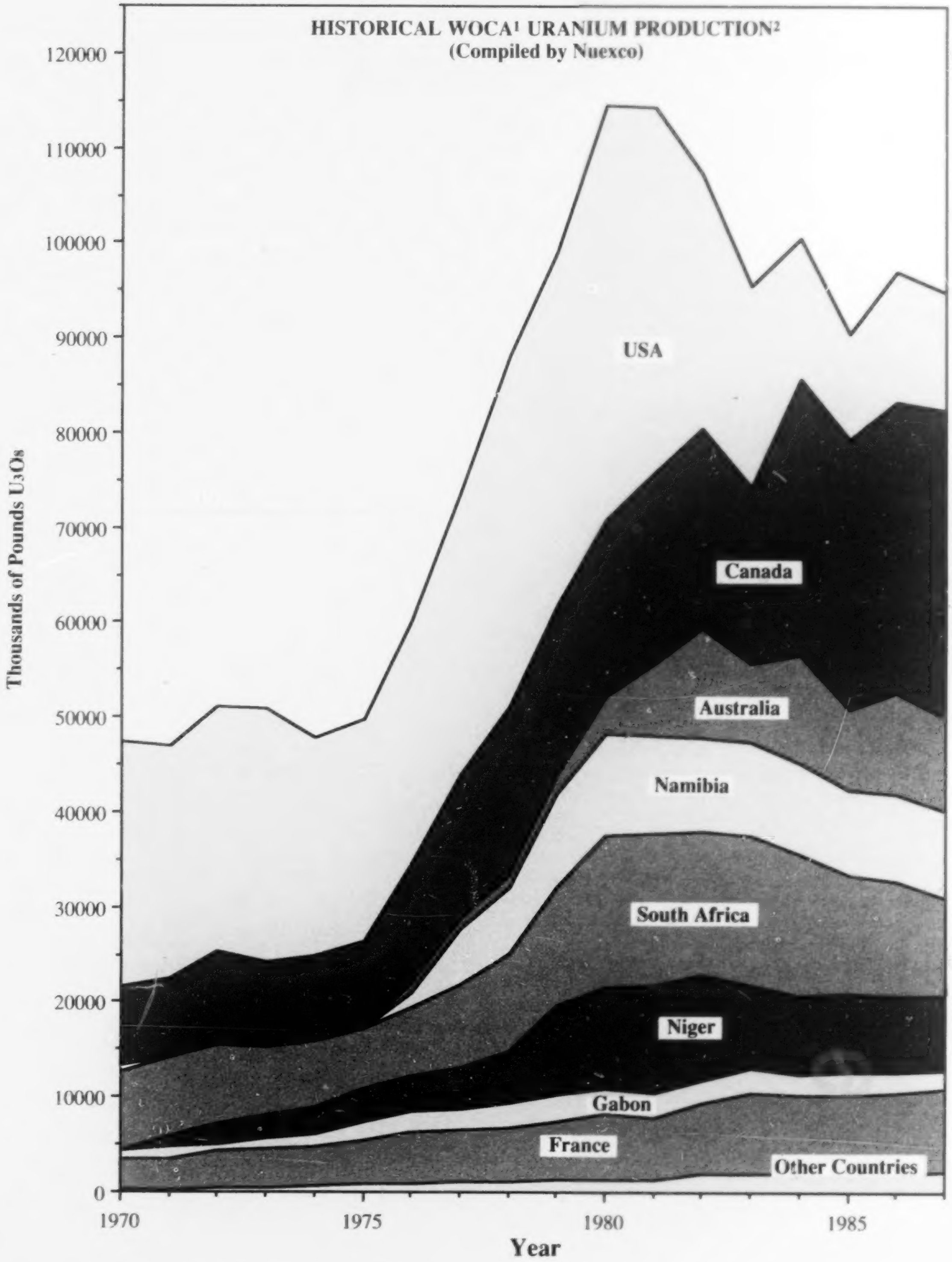

[1] WOCA = World Outside of Centrally-Planned Economic Areas.
[2] 1987 production data are preliminary.

HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

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[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	202.7
1986	Avg.	155.5	101.5	213.0
Jan	1987	—	106.2	215.9
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2
Apr	1987	—	108.3	222.2
May	1987	—	108.1	222.0
June	1987	167.2	108.1	222.2R
July	1987	—	108.7	222.5R
Aug	1987	—	110.5	222.2R
Sep	1987	170.0	109.3	222.8R
Oct	1987	—	108.6	223.0
Nov	1987	—	110.0	222.6
Dec	1987	—	111.9	—

P = Preliminary R = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

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CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.1R	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.5R	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1	140.4	20.47	17.50	16.50	12.63	13.53
Dec	1987	125.4	140.5	20.62R	17.31R	16.37R	12.54R	13.75R
Jan	1988	126.3R	140.8	20.56P	17.51P	16.63P	12.61	13.78P
Feb	1988	125.5	141.3	—	—	—	—	—

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975	Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976	Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977	Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978	Avg	27.14	—	40.3	74.3	658,261	1,502,975
1979	Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
Jan	1987	—	—	128.9	233.9	750,496	529,682
Feb	1987	—	—	130.3	237.0	757,872	598,986
Mar	1987	88.17	197.1	132.4	239.6	762,697	536,006
Apr	1987	—	—	134.1	242.5	761,850	533,487
May	1987	—	—	135.6	243.6	759,428	530,918
Jun	1987	90.74	203.5	136.6	244.9	759,433	573,546
Jul	1987	—	—	138.2	246.8	681,409	566,232
Aug	1987	—	—	140.2	249.9	—	—
Sep	1987	100.79	224.7	142.0	252.4	—	—
Oct	1987	—	—	143.6	255.5	—	—
Nov	1987	—	—	144.8[10]	257.1	—	—
Dec	1987	100.34	267.0	145.9	258.3	—	—
Jan	1988	—	—	147.2	261.5	—	—
Feb	1988	—	—	148.2	—	—	—

P = Preliminary   R = Revised since last month

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[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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SOUTH AFRICA

Consumer Price Index: All Income Groups — Weighted Average
1985=100

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
1967	16.8	16.8	16.9	16.9	17.0	17.0	17.1	17.2	17.2	17.1	17.1	17.1	17.0
1968	17.1	17.1	17.2	17.2	17.2	17.2	17.3	17.4	17.4	17.4	17.5	17.5	17.3
1969	17.5	17.5	17.7	17.7	17.8	17.8	17.8	17.8	17.8	18.1	18.2	18.2	17.8
1970	18.2	18.3	18.4	18.7	18.7	18.8	18.8	18.9	19.0	19.1	19.1	19.1	18.8
1971	19.2	19.2	19.4	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	19.9
1972	20.5	20.6	20.7	20.8	20.9	21.0	21.1	21.4	21.7	21.8	21.8	22.0	21.2
1973	22.2	22.4	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.8	24.0	24.1	23.2
1974	24.2	24.5	24.9	25.0	25.2	25.6	26.0	26.4	26.8	27.1	27.3	27.5	25.9
1975	27.9	28.1	28.3	28.7	28.9	29.3	29.6	29.9	30.1	30.4	30.6	30.8	29.4
1976	31.0	31.2	31.6	31.9	32.2	32.6	32.8	33.2	33.5	33.7	33.8	34.1	32.6
1977	34.4	34.9	35.3	35.6	35.8	36.1	36.5	37.0	37.3	37.5	37.7	37.9	36.3
1978	38.3	38.6	38.7	39.1	39.3	39.4	41.1	41.3	41.6	41.9	42.1	42.3	40.3
1979	42.7	42.9	43.7	44.0	44.2	44.8	46.4	47.1	47.6	47.9	48.0	48.2	45.6
1980	48.6	49.1	49.4	49.9	50.5	51.3	52.1	52.6	53.7	54.7	55.2	55.8	51.9
1981	56.1	57.0	57.4	57.7	58.1	58.8	60.1	61.1	62.1	62.7	63.1	63.6	59.8
1982	63.9	64.7	66.1	67.2	67.7	68.2	68.8	69.6	70.8	71.7	72.1	72.3	68.6
1983	73.2	74.4	75.2	75.8	76.3	76.6	77.2	78.0	78.6	79.3	79.8	80.3	77.0
1984	80.7	81.8	82.8	84.1	84.7	85.6	86.7	87.3	88.1	89.3	90.3	90.9	86.0
1985	92.0	94.9	95.3	97.3	98.4	99.6	100.5	101.6	102.7	104.3	105.6	107.7	100.0
1986	111.0	112.0	113.3	115.4	115.6	116.5	118.8	120.6	122.9	124.2	125.9	127.2	118.6
1987	128.9	130.3	132.4	134.1	135.6	136.6	138.2	140.2	142.0	143.6	145.9	144.8	137.7

Average Declared Working Costs Per Metric Ton of Gold Ore Milled

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
1967	-	-	6.1	-	-	6.2	-	-	6.2	-	-	6.2	6.15
1968	-	-	6.2	-	-	6.2	-	-	6.3	-	-	6.4	6.29
1969	-	-	6.4	-	-	6.4	-	-	6.4	-	-	6.5	6.41
1970	-	-	7.3	-	-	7.3	-	-	7.3	-	-	7.4	7.34
1971	-	-	7.7	-	-	7.8	-	-	7.9	-	-	8.1	7.88
1972	-	-	8.5	-	-	8.7	-	-	8.8	-	-	9.2	8.79
1973	-	-	9.4	-	-	10.3	-	-	11.0	-	-	11.4	10.51
1974	-	-	12.0	-	-	12.6	-	-	13.7	-	-	14.4	13.18
1975	-	-	15.6	-	-	16.4	-	-	17.1	-	-	17.7	16.71
1976	-	-	18.5	-	-	19.1	-	-	19.4	-	-	20.3	19.30
1977	-	-	23.0	-	-	23.2	-	-	23.9	-	-	25.4	23.87
1978	-	-	26.7	-	-	26.2	-	-	27.4	-	-	28.2	27.14
1979	-	-	28.6	-	-	29.4	-	-	30.7	-	-	31.9	30.18
1980	-	-	33.7	-	-	34.5	-	-	36.2	-	-	37.7	35.53
1981	-	-	39.3	-	-	40.4	-	-	43.3	-	-	44.5	41.89
1982	-	-	45.5	-	-	45.8	-	-	48.0	-	-	49.6	47.25
1983	-	-	50.4	-	-	50.5	-	-	52.9	-	-	53.7	51.88
1984	-	-	55.3	-	-	57.0	-	-	60.6	-	-	62.9	58.94
1985	-	-	64.5	-	-	67.4	-	-	70.5	-	-	72.4	68.76
1986	-	-	75.8	-	-	77.7	-	-	81.9	-	-	85.4	80.22
1987	-	-	88.2	-	-	90.7	-	-	100.8	-	-	-	

SOUTH AFRICA — EMPLOYMENT AND WAGES IN MINING AND QUARRYING

Total Employment in Mining and Quarrying

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
1977	623207	702511	706614	700532	715410	712006	707953	707521	713117	707092	692430	663668	696005
1978	620146	660111	658059	660075	666478	664571	670164	673505	670864	675595	674717	662418	663059
1979	664394	680054	689770	682505	689749	692209	699567	692377	686248	692859	699158	697741	688886
1980	699112	705758	708456	710652	717171	714379	715460	716486	710889	720246	716797	705087	711708
1981	729575	725647	705010	719674	726869	728506	735839	722684	724604	717918	720255	709612	722183
1982	700375	705992	725700	707502	715162	707552	702141	705562	704344	701316	707966	683982	705633
1983	688030	697089	695976	697158	701712	706933	704202	698984	696435	698823	695335	690750	697619
1984	683629	696332	709575	707336	703987	711511	711156	716248	721470	717865	717396	701198	708142
1985	711366	727932	708809	724187	708085	724587	741488	739205	750808	720071	750049	741372	728997
1986	743947	751823	759897	756388	754788	756637	756143	760925	765772	763953	761325	752264	756989

Total Salaries and Wages (R 1000) in Mining and Quarrying

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
1977	104876	108702	114713	117467	118499	118114	117022	121280	125491	125597	124607	124366	1420734
1978	117298	116632	121582	116945	124990	126343	134330	136428	132700	135434	136928	137561	1537171
1979	137630	136252	139717	143812	146732	152862	161450	159514	158804	162721	165956	165182	1830632
1980	171548	165790	171573	169415	179128	183739	202403	206514	204731	204602	208345	211829	2279617
1981	219969	210275	210151	217124	219880	237049	249080	245817	251502	248159	253844	257655	2820505
1982	257173	250190	262210	252562	258770	261361	283248	276730	282782	285328	287698	288019	3246071
1983	289075	281412	290586	286708	295701	300177	314566	311789	312264	313276	318344	324451	3638349
1984	320400	328787	323221	322452	322189	341350	363278	354735	359218	363755	369771	365234	4134390
1985	376777	361823	371380	369005	377524	395543	420738	418929	421369	401448	432996	425261	4772793
1986	448604	435950	445387	437563	425544	462365	516832	502968	511363	512897	531509	536970	5767952

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UNITED STATES

		Producer Price Index[1]				Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	274.8	268.8	246.8	85.7	10.26	10.63	8.30	6.94
1981	Avg.	304.1	293.4	272.4	94.0	11.55	11.98	9.12	7.62
1982	Avg.	312.3	299.3	289.1	100.0	12.31	12.93	9.96	8.21
1983	Avg.	315.7	303.1	298.4	103.9	12.58	13.43	10.58	8.67
1984	Avg.	322.6	310.3	311.1	107.7	13.05	13.43	11.07	9.04
1985	Avg.	323.8	308.7	322.2	111.2	13.38	13.74	11.56	9.46
1986	Avg.	312.2	299.8	328.4	114.1	13.20	13.49	11.98	9.65
Jan	1987	313.5	300.9	333.1	—	12.94	12.98	12.18	9.84
Feb	1987	314.9	302.2	334.4	—	12.99	12.83	12.21	9.84
Mar	1987	315.7	302.7	335.9	116.1	13.04	12.79	12.24	9.84
Apr	1987	317.3	305.0	337.7	—	13.16	12.90	12.30	9.82
May	1987	318.3	307.1	338.7	—	12.97	12.92	12.31	9.83
Jun	1987	319.9	308.2	340.1	117.2	13.05	12.93	12.27	9.84
Jul	1987	322.1	309.8	340.8	—	13.06	13.07	12.37	9.89
Aug	1987	323.8	310.6	342.7	—	13.03	13.07	12.34	9.90
Sep	1987	323.3	310.4	344.4	117.8	13.19	13.44	12.56	9.98
Oct	1987	324.9	311.4	345.3	—	12.96	13.06	12.52	9.95
Nov	1987	325.4	311.9	345.8	—	12.89	13.10	12.56	10.00
Dec	1987	325.3	311.7	345.7	118.7	12.78	13.14R	12.62R	10.05R
Jan	1988	104.3[5]	104.5[5]	115.7[5]	—	13.02	13.00—	12.56R	10.03R
Feb	1988	104.4	104.6	116.0	—	13.09P	12.91P	12.54P	10.04P
Mar	1988	—	—	—	—	—	—	12.52P	10.09P

P = Preliminary   R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

[5] 1982 = 100.

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GOVERNMENT STATISTICS

UNITED STATES

Consumer Price Index — U.S. City Average, All Items - All Urban Consumers (Bureau of Labor Statistics) 1982-1984 = 100.0

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	33.4	32.9	32.9	33.0	33.1	33.2	33.4	33.4	33.5	33.6	33.7	33.8	33.9
1968	34.8	34.1	34.2	34.3	34.4	34.5	34.7	34.9	35.0	35.1	35.3	35.4	35.5
1969	36.7	35.6	35.8	36.1	36.3	36.4	36.6	36.8	37.0	37.1	37.3	37.5	37.7
1970	38.8	37.8	38.0	38.2	38.5	38.6	38.8	39.0	39.0	39.2	39.4	39.6	39.8
1971	40.5	39.8	39.9	40.0	40.1	40.3	40.6	40.7	40.8	40.8	40.9	40.9	41.1
1972	41.8	41.1	41.3	41.4	41.5	41.6	41.7	41.9	42.0	42.1	42.3	42.4	42.5
1973	44.4	42.6	42.9	43.3	43.6	43.9	44.2	44.3	45.1	45.2	45.6	45.9	46.2
1974	49.3	46.6	47.2	47.8	48.0	48.6	49.0	49.4	50.0	50.6	51.1	51.5	51.9
1975	53.8	52.1	52.5	52.7	52.9	53.2	53.6	54.2	54.3	54.6	54.9	55.3	55.5
1976	56.9	55.6	55.8	55.9	56.1	56.5	56.8	57.1	57.4	57.6	57.9	58.0	58.2
1977	60.6	58.5	59.1	59.5	60.0	60.3	60.7	61.0	61.2	61.4	61.6	61.9	62.1
1978	65.2	62.5	62.9	63.4	63.9	64.5	65.2	65.7	66.0	66.5	67.1	67.4	67.7
1979	72.6	68.3	69.1	69.8	70.6	71.5	72.3	73.1	73.8	74.6	75.2	75.9	76.7
1980	82.4	77.9	78.9	80.1	81.0	81.8	82.7	82.7	83.3	84.0	84.8	85.5	86.3
1981	90.9	87.0	87.9	88.5	89.1	89.8	90.6	91.6	92.3	93.2	93.4	93.7	94.0
1982	96.5	94.3	94.6	94.5	94.9	95.8	97.0	97.5	97.7	97.9	98.2	98.0	97.6
1983	99.6	97.8	97.9	97.9	98.6	99.2	99.5	99.9	100.2	100.7	101.0	101.2	101.3
1984	103.9	101.9	102.4	102.6	103.1	103.4	103.7	104.1	104.5	105.0	105.3	105.3	105.3
1985	107.6	105.5	106.0	106.4	106.9	107.3	107.6	107.8	108.0	108.3	108.7	109.0	109.3
1986	109.6	109.6	109.3	108.8	108.6	108.9	109.5	109.5	109.7	110.2	110.3	110.4	110.5
1987	113.6	111.2	111.6	112.1	112.7	113.1	113.5	113.8	114.4	115.0	115.3	115.4	115.4

Producer Price Index — Industrial Commodities (Bureau of Labor Statistics) 1982 = 100.0

Year	Avg.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1967	32.0	31.9	31.9	31.9	31.9	31.9	31.9	31.9	32.0	32.1	32.2	32.3	32.4
1968	32.8	32.5	32.7	32.7	32.8	32.8	32.8	32.8	32.8	32.9	33.1	33.1	33.2
1969	33.9	33.4	33.6	33.7	33.8	33.8	33.8	33.8	34.0	34.1	34.3	34.4	34.5
1970	35.2	34.7	34.8	34.8	35.0	35.1	35.2	35.3	35.3	35.4	35.6	35.6	35.8
1971	36.5	35.9	36.0	36.2	36.3	36.4	36.5	36.7	36.9	36.9	36.9	36.8	37.0
1972	37.8	37.1	37.3	37.4	37.5	37.7	37.8	37.8	37.9	38.0	38.0	38.1	38.2
1973	40.3	38.4	38.8	39.3	39.8	40.1	40.3	40.4	40.6	40.8	41.1	41.7	42.3
1974	49.2	43.3	44.2	45.6	46.9	48.2	49.2	50.5	51.7	52.1	52.8	53.1	53.2
1975	54.9	53.6	53.9	54.1	54.3	54.5	54.6	54.8	55.1	55.4	56.0	56.1	56.4
1976	58.4	56.8	57.0	57.3	57.7	57.8	58.1	58.5	58.9	59.2	59.7	59.9	60.0
1977	62.5	60.3	60.9	61.4	61.9	62.2	62.3	62.7	63.1	63.3	63.7	63.8	64.1
1978	67.0	64.6	65.0	65.4	66.0	66.4	66.8	67.3	67.7	68.0	68.7	69.2	69.6
1979	75.7	70.5	71.3	72.2	73.3	74.2	74.9	76.1	77.0	78.2	79.7	80.3	81.1
1980	88.0	83.4	85.1	86.0	86.9	87.1	87.6	88.4	89.1	89.3	90.3	90.7	91.8
1981	97.4	93.3	94.7	95.9	97.2	97.6	97.7	98.1	98.4	98.4	99.0	99.0	99.3
1982	100.0	99.8	99.8	99.6	99.2	99.1	99.5	100.2	100.3	100.1	100.6	100.9	100.9
1983	101.1	100.5	100.5	100.4	100.0	100.4	100.9	101.4	101.6	101.5	102.0	101.9	102.0
1984	103.3	102.2	102.7	103.1	103.3	103.5	103.7	103.7	103.5	103.2	103.6	103.7	103.4
1985	103.7	103.4	103.2	103.3	103.7	104.2	104.0	103.9	103.7	103.2	103.8	104.0	104.1
1986	100.0	103.7	102.1	100.5	99.8	99.8	99.8	98.8	98.6	98.8	99.1	99.2	99.2
1987	102.6	100.4	100.8	101.1	101.6	101.9	102.4	103.1	103.7	103.5	104.0	104.2	104.1

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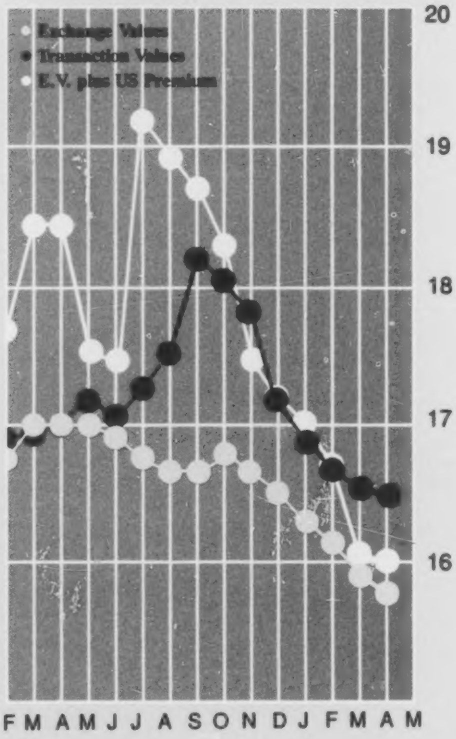

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

May 1988 No. 237

R. GENE CLARK, *EDITOR* FRANCE A. HEAD, *ASSISTANT EDITOR*

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NUEXCO

To Our Readers

* * *

Nuexco International Corporation is pleased to announce that it has acquired the brokerage, trading, and publication operations of SWUCO, Inc. and its subsidiary, the SWUCO Inventory Storage Corporation ("SISCO"). SWUCO's and SISCO's trading and brokerage activities will be continued as subsidiaries of Nuexco Trading Corporation (NTC), and the publications activities, including the SWUCO Monthly Report, will be continued as a subsidiary of Nuexco Information Services (NIS).

Walt Wolf, SWUCO's President, is joining NUEXCO, devoting most of his efforts to serving NTC in uranium and enrichment brokerage and trading activities. He will also serve as President of newly-formed NUEXCO subsidiaries with the SWUCO and SISCO names, which will engage in other NUEXCO activities.

Walt has served the nuclear industry since 1958, beginning with the General Electric Company at the Hanford Works in 1958, and the GE Nuclear Energy Division in 1960. He joined Nuclear Fuel Services (NFS) in Rockville, Maryland as Sales Manager in 1972, and was appointed Vice President of SWUCO in April 1973, at the time of its founding.

Walt holds a B.S. degree in Mathematics from Northwestern University and an M.B.A. from the University of Santa Clara. He currently serves as Chairman of the Board of Governors of the World Nuclear Fuel Market and is an active member of the American Nuclear Society and the U.S. Council for Energy Awareness. These activities, together with his work at SWUCO, have made Walt Wolf well known and respected throughout the industry.

In addition to Walt, two SWUCO staff members, **R. Lee Clanton, Jr.** and **Anita E. Blumenthal**, are being integrated into NUEXCO in areas corresponding to their former SWUCO responsibilities, and they will continue to be based in the Washington, D.C. area.

Before joining SWUCO in 1983 as Director of Brokerage, **Lee** spent nine years as a nuclear engineer with Duke Power Company where he managed enrichment service contracts with the US Department of Energy and was involved in secondary market transactions of SWU and enriched uranium. A registered Professional Engineer, Lee holds a B.A. in Engineering from North Carolina State University. Lee will continue brokerage activities with NTC.

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Anita's background includes editing and production of monthly newsletters and annual publications in the legal, agricultural and computer fields. In March 1983, she joined SWUCO as Manager of Publications, responsible for the SWUCO report. Anita holds two degrees in English - a B.A. from Brandeis University and an M.A. from the New University of Ulster in Northern Ireland. Anita will work for NIS.

We are also pleased to announced the addition last month of two new members to NIS:

France A. Head will be succeeding Charles B. Lewis as Associate Editor of the Monthly Report. France has over six years of experience in the uranium industry, acquired during employment with Minatome Corporation. She holds a B.A. in French and an M.B.A., both from the University of Colorado.

David S. Schramm will be responsible for providing analytical support for market and consulting studies. David is a recent honors graduate of the Colorado School of Mines where he received a M.S. in Mineral Economics.

Charlie Lewis moved to California at the end of April to pursue other endeavors. We wish him continued success in the future.

* * *

The 1987 Annual Review will be mailed to our subscribers this month. This Special Report provides a summary of nuclear fuel activities in 1987 as well as analysis of pricing trends on the spot/near-term markets for uranium and secondary market enrichment services. The NUEXCO market values are also included in a series of tables for reference.

If you would like to purchase additional copies of the 1987 Annual Review, please contact Lori Costarella in our Denver office at (303) 893-4015.

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PRICING

April 30, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$15.75**/lb. U_3O_8	5,620[2]	2,515[2]
US Premium	**$0.25**		
UF_6 VALUE	**$45.25**/kg U as UF_6	5,620[2]	2,515[2]
US Premium	**$0.50**		
CONVERSION VALUE	**$1.80**/lb. U as UF_6	0	750
SWU VALUE **0.3 tails assay:**	**$68**/SWU	305	260
LOAN RATE	**3.5%**/annum	7,600	0

	\$/lb. U_3O_8	**Millions of Pounds**	**Number of Transactions**	**Number of Months**
TRANSACTION VALUE	**16.45**	**3.3**	**25**	**5**

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

[2] For either uranium concentrates or uranium hexafluoride.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers.
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of April 30, 1988)

The **Exchange Value** is **$15.75** per pound U_3O_8, down $0.15 since last month. US-origin U_3O_8 is commanding a **premium** (relative to the Exchange Value) of **$0.25** per pound U_3O_8 (up $0.10).

Active supply of natural uranium (concentrates and UF_6) for spot term delivery totals **5,600,000** pounds U_3O_8 equivalent, down 400,000 pounds since last month. The corresponding figure for **active demand** is **1,200,000** pounds, down 1,300,000 pounds. The spot and near-term supply-demand ratio is 4.8, up from 2.4 at the end of March.

The *Current Market Data* section of this Report lists one natural uranium sale for less than 300,000 pounds U_3O_8 equivalent, which is included in the Transaction Value calculation.

The **Transaction Value** is **$16.45** per pound U_3O_8, down $0.10 since last month. The calculation extends over a 5-month period and includes 25 transactions involving 3.3 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$45.25** per kilogram U in UF_6, down $0.25. The **premium** for US-origin UF_6 is **$0.50** per kilogram U (no change). No transactions involving UF_6 are reported.

The **Conversion Value** is **$1.80** per pound U as UF_6, unchanged since last month. There is no active supply of secondary market conversion services reported this month. Active demand totals 750,000 pounds U as UF_6. One secondary market conversion transaction is reported.

The **Loan Rate** is **3.5 percent** per annum, unchanged from last month. No loan transactions are reported.

* * *

The **Exchange Value** declined $0.15, to $15.75 per pound U_3O_8 this month. Activity in the U_3O_8 market was limited in April, and only one transaction is reported. Aggressive offering prices at or below this month's Exchange Value failed to stimulate significant buyer interest, except in the above mentioned case in which a European utility purchased less than 300,000 pounds of non-US-origin U_3O_8 in a transaction involving special payment terms and delivery conditions. Although supply remains substantial, spot market demand for concentrates was weaker than in the previous month, causing downward pressure on prices. Most of the existing demand came from three US utilities considering discretionary purchases; at the end of April, one other US utility was conducting negotiations involving a significant quantity of material, although that transaction had not been finalized.

The market for US-origin concentrates was sluggish in April, and no US-origin transactions are reported, even though most of the concentrate demand is for US-origin material. Supply of US-origin uranium does not appear to have significantly diminished. The Premium (relative to the Exchange Value) for US-origin U_3O_8 increased $0.10, to $0.25 per pound U_3O_8, creating a level of $16.00 for buyers specifying only US-origin U_3O_8. However, two recent external events have caused many US producers and potential US-origin buyers temporarily to withdraw from active participation in the US-origin market.

On March 30, 1988, the US Senate passed the Uranium Revitalization, Tailings Reclamation and Enrichment Act (S.2097), by a vote of 62 to 28, including in the bill a provision calling for certain restrictions on domestic usage of non-US-origin uranium. While the bill's eventual passage by the House of Representatives and its signature into law by President Reagan are uncertain, the Senate's passage of the bill did raise the hopes of some US producers that import restrictions might eventually be imposed in the USA. As a result, some producers withdrew offers and stepped back from aggressive competition.

On April 27, the US Supreme Court heard oral arguments in the US Producers vs. DOE lawsuit. The Court's questioning focused on the definition of viability, and not on the narrow legal issue of whether DOE had *discretion* in restricting enrichment of imported uranium when the domestic uranium industry had been declared to be non-viable. The Court asked for clarification of whether viability meant financial profitability, or the ability of the industry to supply 100 percent of domestic needs. Given the Justices' line of questioning, it is possible that the case could be sent back to the lower courts for further findings on the issue of industry viability. Thus, DOE's chances of having the earlier Appeals Court's decision overturned by the Supreme Court appeared to have improved. A decision is likely to be made before the Court recesses in June.

The Supreme Court hearing came too late in the month to influence the month's transactions, and in general, the two events' effects on perceptions of the US-origin market in the longer term remain to be seen, although they suggest

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almost opposite scenarios. This could provide a continuation of the market's recent relative inactivity. If the small price difference between US and non-US origins continues, many US utilities may find little reason to purchase non-US-origin material until the origin issue is clarified.

The **UF6 Value** declined $0.25, to $45.25 per kg U as UF6 during April. For the second month, the UF6 market was inactive, and no transactions are reported. Active supply of natural UF6 continues to be relatively weak, compared to the level of U3O8 supply, and little US-origin UF6 is available. Persistently weak demand, combined with the increased competition among sellers of both natural and enriched UF6 for the few opportunities that do appear, continue to place downward pressure on prices. At the end of April, one US utility asked for another round of bids for a significant quantity of enriched material, and another was negotiating to purchase natural UF6. In addition, a European utility continued to evaluate offers for natural UF6.

The Premium (relative to the UF6 Value) for US-origin was unchanged from last month, at $0.50 per Kg U as UF6, as the limited natural UF6 supply was not actively marketed.

* * *

The **Loan Rate** remains unchanged this month, at 3.5 percent per annum. Loan supply remains large, but no firm demand exists at the present time. The absence of firm demand continues to thwart potential lenders' efforts to find borrowers. No loan transactions are reported this month.

* * *

The **Conversion Value** is unchanged at $1.80 per pound U as UF6. One US utility reportedly is negotiating to dispose of its excess conversion, and at least two other utilities are expected to enter the market for conversion services within the next several months. At present, however, the conversion market remains thin. No secondary market conversion transactions are reported this month.

ENRICHED URANIUM AND SWU

The **SWU Value** is $68 per SWU, down $2 since last month. Increased interest by potential SWU buyers was offset by a number of SWU sellers offering enrichment services below the $70 level, causing downward price pressure. Primary suppliers continue to participate in the secondary market, directly or indirectly, effectively increasing the available supply. As of the end of April, a US utility had solicited a second round of bids for a significant quantity of SWU contained in enriched product, and another was evaluating offers. One SWU transaction is reported this month involving less than 50,000 SWU in a transaction involving extended delivery and payment late next year.

As in the past, fluctuations in the SWU value reflect firming or softening within a general price range, and varies depending on the terms of a particular transaction. Payment terms, SWU origin, delivery location, and flexibility of enrichment assay all affect the prices offered by SWU sellers. In a thin market, the appearance of one or more large, firm buyers can cause competition among sellers to increase, and consequently drive the price down quickly.

Of late, the non-western-origin SWU suppliers have quoted the lower prices because western buyers associate a certain degree of risk with new supply sources. SWU prices in the middle of the range generally reflect sellers of excess DOE-origin SWU commitments or sellers of enriched uranium inventory with location or assay constraints. At the high end of the price spectrum are sellers of excess Eurodif or Urenco SWU commitments. Although these sellers offer the most flexibility in delivery location and product assay, the weakness of the US dollar in relation to European currencies has caused offering prices for those SWU to rise in terms of US dollars.

While the recent terminations of DOE SWU commitments in the 1996-98 period by a number of utilities worldwide could indicate an increase in secondary and spot market SWU activity, such expectations might be premature. Most utilities, particularly the larger ones, viewed cancellations in the April 1, 1988 notice as merely preserving options for enrichment in the [illegible], rather than as an abandonment of DOE supply. NUEXCO expects that several of these utilities will ultimately purchase some combination of DOE, Eurodif or Urenco supply for the bulk of their requirements after 1995. Thus, secondary market SWU activity could increase in the mid-1990s, but the response to the April 1 notice is not an accurate indicator.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	**This Month (Apr 30, 1988)**	**Last Month (Mar 31, 1988)**	**12 Months Ago (Apr 30, 1987)**	**This Month (Apr 30, 1988)**	**Last Month (Mar 31, 1988)**	**12 Months Ago (Apr 30, 1987)**
Australia (dollar)	20.76	21.51	26.15	53.98	55.91	67.97
Belgium (comm. franc)	550.12	555.56	631.50	1,430	1,444	1,642
Canada (dollar)	19.37	19.64	22.73	50.36	51.07	59.09
EEC (ecu)	12.68	12.80	14.72	32.97	33.27	38.26
Finland (markka)	62.82	63.83	74.46	163.33	165.94	193.59
France (franc)	89.29	89.53	101.49	232.12	232.75	263.86
FRG (mark)	26.29	26.40	30.45	68.34	68.64	79.16
Italy (lira)	19,529	19,557	21,778	50,771	50,844	56,618
Japan (yen)	1,961	1,984	2,366	5,098	5,157	6,152
Netherlands (guilder)	29.48	29.66	34.39	76.64	77.12	89.41
South Africa (rand)	33.83	33.82	34.03	87.96	87.93	88.48
Spain (peseta)	1,737	1,770	2,140	4,516	4,603	5,563
Sweden (krona)	92.27	93.92	106.65	239.87	244.16	277.27
Switzerland (franc)	21.79	21.79	24.96	56.65	56.65	64.88
UK (pound)	8.40	8.45	10.24	21.84	21.97	26.62
US (dollar)	15.75	15.90	17.00	40.95	41.34	44.20

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	**This Month (Apr 30, 1988)**	**Last Month (Mar 31, 1988)**	**12 Months Ago (Apr 30, 1987)**	**This Month (Apr 30, 1988)**	**Last Month (Mar 31, 1988)**	**12 Months Ago (Apr 30, 1987)**
Australia (dollar)	21.69	22.39	26.15	56.38	58.20	67.97
Belgium (comm. franc)	574.57	578.27	631.50	1,494	1,503	1,642
Canada (dollar)	20.23	20.45	22.73	52.60	53.16	59.09
EEC (ecu)	13.25	13.32	14.72	34.44	34.63	38.26
Finland (markka)	65.62	66.44	74.46	170.59	172.73	193.59
France (franc)	93.25	93.19	101.49	242.44	242.27	263.86
FRG (mark)	27.45	27.48	30.45	71.37	71.45	79.16
Italy (lira)	20,397	20,357	21,778	53,027	52,923	56,618
Japan (yen)	2,048	2,065	2,366	5,324	5,368	6,152
Netherlands (guilder)	30.79	30.88	34.39	80.04	80.27	89.41
South Africa (rand)	35.34	35.21	34.03	91.87	91.53	88.48
Spain (peseta)	1,814	1,843	2,140	4,717	4,791	5,563
Sweden (krona)	96.37	97.76	106.65	250.53	254.14	277.27
Switzerland (franc)	22.76	22.68	24.96	59.17	58.96	64.88
UK (pound)	8.77	8.80	10.24	22.18	22.87	26.62
US (dollar)	16.45	16.55	17.00	42.77	43.03	44.20

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb U as UF_6			per kg U as UF_6		
Country (currency)	**This Month (Apr 30, 1988)**	**Last Month (Mar 31, 1988)**	**12 Months Ago (Apr 30, 1987)**	**This Month (Apr 30, 1988)**	**Last Month (Mar 31, 1988)**	**12 Months Ago (Apr 30, 1987)**
Australia (dollar)	2.37	2.43	2.77	5.23	5.37	6.10
Belgium (comm. franc)	62.87	62.89	66.86	138.61	138.66	147.41
Canada (dollar)	2.21	2.22	2.41	4.88	4.90	5.31
EEC (ecu)	1.45	1.45	1.56	3.20	3.19	3.44
Finland (markka)	7.18	7.23	7.88	15.83	15.93	17.38
France (franc)	10.20	10.14	10.75	22.50	22.34	23.69
FRG (mark)	3.00	2.99	3.22	6.62	6.59	7.11
Italy (lira)	2,232	2,214	2,306	4,920	4,881	5,084
Japan (yen)	224.10	224.55	250.56	494.06	495.05	552.38
Netherlands (guilder)	3.37	3.36	3.64	7.43	7.40	8.03
South Africa (rand)	3.87	3.83	3.60	8.52	8.44	7.94
Spain (peseta)	198.54	200.42	226.56	437.71	441.86	499.47
Sweden (krona)	10.54	10.63	11.29	23.25	23.44	24.90
Switzerland (franc)	2.49	2.47	2.64	5.49	5.44	5.83
UK (pound)	.96	.96	1.08	2.12	2.11	2.39
US (dollar)	1.80	1.80	1.80	3.97	3.97	3.97

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	SWU Value at 0.30% Tails Assay (Apr 30, 1988)	**SWU Value at 0.30% Tails Assay (Mar 31, 1988)**	**UF_6 Value per kg U as UF_6 This Month (Apr 30, 1988)**	**UF_6 Value per kg U as UF_6 Last Month (Mar 31, 1988)**
Australia (dollar)	89.65	94.68	59.65	61.54
Belgium (comm. franc)	2,375	2,446	1,581	1,590
Canada (dollar)	83.64	86.48	55.65	56.21
EEC (ecu)	54.76	56.34	36.43	36.62
Finland (markka)	271.24	281.01	180.49	182.65
France (franc)	385.49	394.14	256.51	256.19
FRG (mark)	113.48	116.24	75.51	75.55
Italy (lira)	84,315	86,101	56,107	55,966
Japan (yen)	8,466	8,733	5,634	5,676
Netherlands (guilder)	127.27	130.60	84.69	84.88
South Africa (rand)	146.08	148.90	97.20	96.78
Spain (peseta)	7,501	7,794	4,991	5,066
Sweden (krona)	398.36	413.47	265.08	268.75
Switzerland (franc)	94.08	95.93	62.60	62.35
UK (pound)	36.27	37.20	24.13	24.18
US (dollar)	68.00	70.00	45.25	45.50

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4289	1988	101 - 300	93-97	Intermediary	Utility	

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4290	1989	less than 50	103-107	Intermediary	Utility		

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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URANIUM SUPPLY
(April 30, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale: ACTIVE			
87-1002	270	—	
87-1023	500	500 per year	1988-90
87-1061*	1,000	700 per year	1988-91
87-1123*	1,000	1,000 per year	
87-1141	500	200 per year	1989-92
87-1152*	300	—	1988
87-1159	60	—	
87-1161	1,000	1,000 per year	UF_6
88-1000A*	140	—	U_3O_8 or UF_6
88-1000B	80		1988, UF_6
88-1001*	200	200 per year	1988-91
88-1026	250	—	1988
88-1033A*	130	—	1988, UF_{6e}
88-1036	100	—	1988
88-1041*	90	—	UF_6
87-1001*	—	500 per year	1989 on
87-1005*		250 per year	1988-95
TOTAL:	5,620		
INACTIVE			
87-1019*	1,000	1,000 per year	1988-91
87-1041*	650	—	UF_6
87-1053	100	400 per year	1989 on
87-1130*	550	—	
87-1135	260	—	UF_6
87-1136	260	—	UF_6
TOTAL:	2,820		

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*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1156.

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URANIUM DEMAND
(April 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
88-1035A	40	—	1988, UF_6e
88-1045	225	525	1989-90, UF_6
88-1060*	300	—	1988, U_3O_8/UF_6
87-1064*	400	400 per year	1988-90
87-1069*	50	—	1988
88-1072*	100	—	1988
88-1075A*	50	—	1988, UF_6e
87-1013	—	1,200 per year	1990-95
87-1021*	—	200 per year	1992-99
87-1134	—	260	1989
87-1172	—	500 per year	1990 on
88-1044	—	2,400	1991-95
88-1056	—	500 per year	1989-93, U_3O_8 or UF_6
88-1062*	—	200 per year	1990-on
TOTAL:	1,165		
INACTIVE			
87-1154A	80	—	1988, UF_6e
88-1014	190	—	1988
87-1163*	—	160	1989-93
87-1166	—	650	1989, UF_6
TOTAL:	270		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1121, 87-1040, 88-1013A, 88-1017A.

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LOAN SUPPLY AND DEMAND
(April 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1012	2,000	—	
87-1071	1,000	—	UF_6
87-1157	4,000	--	
88-1057*	600	—	
TOTAL:	7,600		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
TOTAL:	2,000		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month:

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CONVERSION SUPPLY AND DEMAND
(April 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6)		Remarks
	Within 3 Years	Beyond 3 Years	
Available for Sale INACTIVE			
87-1008*	770	475	1988
TOTAL:	770		
Inquiries to Purchase: ACTIVE			
88-1034*	750	—	1990
TOTAL:	750		
INACTIVE			
88-1021	65	—	
88-1059*	100	—	UF_6
TOTAL:	165		

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*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 88-1004.

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SWU SUPPLY AND DEMAND
(April 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
87-1058	90	—	1988
87-1068*	200	—	1988,UF$_6$e
88-1033B	15	—	1988,UF$_6$e
TOTAL:	305		
INACTIVE			
87-1004	55	—	1988
87-1128*	360	—	1988
TOTAL:	415		
Inquiries to Purchase:			
ACTIVE			
88-1035B	20	—	1988, UF$_6$e
88-1058*	150	—	
88-1074*	80	—	1988
88-1075B*	10	—	1988, UF$_6$e
TOTAL:	260		
INACTIVE			
87-1154B	20	—	1988, UF$_6$e
TOTAL:	20		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1065, 87-1171, 88-1013B, 88-1017B, 88-1050.

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RECENT DEVELOPMENTS

SWEDEN

The Swedish government introduced a new energy bill to its Parliament on March 2, 1988, scheduling the first two nuclear reactor shutdowns. This action represents the first substantial shutdown plan following Sweden's 1980 referendum vote to phase out its twelve nuclear power plants by 2010 (see Report #196, December 1984). The bill calls for the permanent closure of one of the Barseback units and one of the Ringhals units in 1995 and 1996. While the legislation is expected to be passed by Parliament in May or June without any major revisions, certain vague provisions concerning shutdown costs and energy replacement may be clarified as it is debated.

Although the actual reactors to be shut down will not be determined until 1990, the Barseback and Ringhals stations were selected because of their proximity to highly populated areas. Sydkraft's Barseback station, located on Sweden's southwest coast, has long been a candidate for early closure because over two million people live within a fifty kilometer radius of the plant. The Barseback station is only about 20 kilometers across the Straits of Oeresund from Copenhagen, Denmark, the largest city in Scandinavia. The Danish public and government's strong anti-nuclear sentiment was an important factor in Sweden's selection of Barseback for early closure.

Sydkraft vigorously opposes decommissioning Barseback, and reportedly is seeking about US $2.5 billion in damages for having to retire the plant before the end of its useful life. Sydkraft also announced it would build the largest coal-fired plant in Europe if its nuclear plants were closed, even though the government has stated that it will not approve any large coal-condensation plants.

The four-unit Ringhals station, also situated on Sweden's coast south of Gothenburg, is operated by the Swedish State Power Board (SSPB). Approximately 300,000 people live within 50 kilometers of the station.

The energy bill did not specify how utilities would be compensated nor how the government planned to replace nuclear energy. The government believes an aggressive energy conservation program will compensate for most of the electricity generating capacity cancelled, based on its estimates for total energy consumption in the late 1990s of 135-140 TWh (total consumption in 1987 was 129 TWh). A review of the situation is planned for 1990, after further study of long-term energy requirements and replacement options, and the future direction of the Swedish energy program will be decided at that time.

According to some reports, the phase-out of nuclear power in Sweden could cause the cost of electricity to more than double each year until the mid-1990s, and the SSPB has warned of increasing power shortages, already a common problem in recent winters due to insufficient generating capacity. Sweden's successful nuclear operating history, high capacity factors, indigenous reactor supply infrastructure, and comprehensive waste program make the early closure of units all the more problematic.

USA

US Supreme Court Holds Hearing on the US Producers vs. DOE Lawsuit

The Supreme Court heard oral arguments in the US Producers vs. DOE lawsuit on April 27, 1988. Mr. Thomas Merrill, the Deputy Solicitor General from the Department of Justice, represented DOE; Mr. Peter Nickles of the Washington law firm, Covington & Burling, argued on behalf of the US Producers. Each party had 30 minutes to present its side of the case and to answer questions from the nine Supreme Court Justices. Both parties had expected the Court's line of questioning to center on the statutory interpretation of Section 161(v) of the Atomic Energy Act, the interpretation of which is critical to the issue of whether DOE has discretion or is required to apply restrictions on the enrichment of non-US uranium when the Secretary of Energy has declared the domestic uranium industry to be non-viable. Instead, the Justices focused the majority of their questions on the definition of industry "viability". Additionally, in an unusual move, the Justices cut short both attorneys' preamble by beginning the questioning early in the session.

The Court queried Mr. Merrill for the first 30 minutes, beginning with a request for clarification of the definition of viability and whether it meant financial profitability or the ability of the industry to satisfy 100 percent of the domestic nuclear power industry needs. Mr. Merrill's response that financial profitability was not necessarily an indicator of viability elicited further questioning with Justice O'Connor expressing difficulty in understanding how a domestic industry could be available to meet national needs if it couldn't make any money. Mr. Nickles was presented with similar questions concerning viability and when asked by Justice Scalia if his definition of viability was the ability of the industry to meet the nation's

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civilian and military requirements in the event of a cutoff of non-US uranium, Nickles acknowledged he was in agreement with DOE on that point.

DOE has repeatedly asserted that enrichment restrictions would actually be counterproductive and would not help the domestic uranium industry in the long run. Mr. Merrill stated, "...the Secretary's position is that because Section 161(v) applies only to enrichment of raw uranium and does not restrict imports of enriched uranium and because there are now two European consortia that actually compete with DOE to provide enriched uranium, that the imposition of restrictions on unenriched uranium would simply induce domestic utilities in large numbers to flee overseas to these other competitors of DOE and purchase enriched uranium for direct import into the United States. So, for that reason, at this point in time, even though imports are a fairly large aspect of the picture, the particular mechanism that Section 161(v) establishes would not provide any relief to the industry."

The Court was also interested in clarification of whether Congress meant to subsidize the uranium industry through import restrictions if such subsidization would result in a less than 100 percent viable industry. Following Mr. Nickles' affirmation, Justice Scalia said, "We've got a clash of very difficult positions here".

The case is unusual for several reasons. The statutory language of Section 161(v) was written over 20 years ago when the private sector of the US uranium industry was in its infancy. One undisputed intent of Section 161(v) at that time was to encourage the privatization of the enrichment industry, previously a virtual government monopoly, and to ensure sufficient uranium resources for domestic requirements and national security. However, in the context of the changed circumstances of the 1980s, the statute's impact is substantially altered.

Governmental agencies have usually received deference in interpreting the meaning of the statutory language which they have been authorized to implement. This deference, however, was not sufficient to persuade the US District and Tenth Circuit Courts that, in this case, the DOE interpretation of the statute was correct. The lower courts have not focused on analyzing the wording of Section 161(v), "...to the extent necessary to assure the maintenance of a viable domestic industry", but rather have based their rulings on the literal interpretation of the word "shall", as mandating restrictions on the enrichment of non-US-source uranium if the domestic industry is determined to be non-viable. The Supreme Court, however, indicated several times that there may be questions of fact that the lower courts had left unanswered (primarily relating to viability), thus raising the possibility of a remand to the district court for findings on these issues.

As a rule, the Supreme Court does not review a case unless:

1. it presents a unique legal point
2. there are conflicting decisions between circuit courts; or
3. its potential impact would be widespread and significant.

The outcome of this litigation will have far-reaching effects on the domestic mining industry, the government's enrichment business, and relations with major trade partners, especially Australia and Canada, who both filed briefs in support of DOE. Whether this was a major factor in the Supreme Court's consideration of the case is unclear.

Some possible outcomes of the hearing include:

1. The Supreme Court decides in favor of the US Producers on the statutory interpretation of Section 161(v) and remands back to the District Court to make findings of fact (which have essentially been ignored in the case) as to the level of import restrictions necessary to make the domestic mining industry viable. The District Court would probably require the DOE to conduct a rulemaking on the issue, pursuant to its original order.
2. The Court decides in favor of DOE on the statutory interpretation of 161(v) and remands back to the District Court to determine if any restrictions would restore viability to the industry.
3. The Court does not decide in favor of either party and remands back to the lower courts to examine the viability and restriction level issues.

These are but three of several possible results, but any one of them will cause the legal process to start over again and further prolong this already lengthy litigation. A remand will work in favor of DOE, as it is almost certain that the Stay of Judge Carrigan's order requiring DOE to restrict enrichment of imports would remain in place. This litigation then would take a back seat to the anticipated impact of a ratified Free Trade Agreement (FTA) or the enactment of legislation such as S.2097, the *Uranium Revitalization, Tailings Reclamation and Enrichment Act of 1987*. In any event, a ruling should be made before the Supreme Court recesses in June.

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THE US URANIUM REVITALIZATION, TAILINGS RECLAMATION AND ENRICHMENT ACT,TITLE I

On November 4, 1987, the US Senate Committee on Energy and Natural Resources reported out to the Senate bill number S.1846 (*Uranium Revitalization, Tailings Reclamation and Enrichment Act of 1987*). In early 1988, the bill was reintroduced as S.2097, without some of its earlier provisions that had caused jurisdictional conflict with the Senate Finance Committee. One of the deleted provisions comprised most of Title I of S.1846, dealing primarily with establishing a fee on the use of imported uranium by US utilities. These provisions were reintroduced by amendment on the floor of the Senate on March 30, 1988. In a key vote, a motion to block the reintroduction of the deleted provisions was defeated by a 47-45 margin. The full bill S.2097, again with uranium import provisions, was subsequently passed by a vote of 62-28 in the Senate. The bill now goes to the US House of Representatives for its consideration.

Key members of House committees having jurisdiction over such matters seem to be favorably disposed to the US uranium industry, but opposed to the bill's provisions on uranium enrichment. The Reagan Administration has stated that it can accept the uranium enrichment provisions of S.2097, although the Administration would like to see immediate full privatization of the enrichment enterprise. However, key officials within the Administration have stated privately that the uranium import usage fee provision is unacceptable because of its trade-protectionist nature, and that this provision alone would prompt a Presidential veto of the bill.

This bill is the "rebirth" of bill S.1004, introduced in the previous (99th) Congress. As the bill's proposed title implies, it contains provisions to "revitalize" the US uranium industry by imposing a sliding fee on the US consumption of imported uranium, sets up a mechanism for funding the cleanup of uranium mill tailings at active (i.e., licensed) mill sites, and requires the formation of a government corporation to own and operate the US uranium enrichment enterprise.

From the standpoint of the world uranium market, the most important provision of S.2097 is the import usage fee in Title I. (Title I is reproduced in its entirety at the end of this article.) The sliding-scale fee is to be collected from US utilities at the time of loading new fuel assemblies into each power reactor, and the per-kilogram fee is based on the percentage of the newly loaded fuel that is derived from imported uranium (Table 1).

Table 1
Proposed Usage Fees for Non-US Uranium

Fee Rate	Fraction of Assemblies' Mass of Non-US Origin
No Fee	First 37.5% of mass that is non-US origin
$200/kg	Fraction of mass comprising between 37.5% and 55% non-US origin
$250/kg	Fraction of mass comprising between 55% and 60% non-US origin
$350/kg	Fraction of mass comprising between 60% and 70% non-US origin
$400/kg	Fraction of mass comprising between 70% and 80% non-US origin
$500/kg	Fraction of mass comprising more than 80% non-US origin

Beginning January 1, 1995, there would be no fee on the first 50 percent non-US origin fraction in newly-loaded assemblies. The revenues from this fee would be put directly into the general treasury fund of the United States.

The calculation of the usage fee is based on a concept called "Equivalent Uranium" in the Act. The term refers to the sum of any natural (unenriched) uranium loaded into a fuel assembly and the natural uranium required to produce the assembly's enriched uranium, based on the US DOE's Standard Table of Enrichment Services and the actual tails assay under which the enrichment services were ordered . "Equivalent" specifically excludes any uranium involved in "overfeeding" (i.e., the uranium in excess of an enrichment customer's delivered feed material required to produce a given quantity of enriched uranium, when the enricher operates his plant at a higher tails assay than the one specified in the enrichment transaction).

In essence, a reactor owner loading fresh assemblies, derived in part or whole from non-US-origin uranium, would calculate the non-US-origin fraction of newly loaded fuel's equivalent uranium, and apply that percentage to the fuel's enriched uranium mass to determine (on the basis of the above table) the applicable usage fee for a given calendar year. The usage fee applies

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to the aggregate of fuel in assemblies loaded in a given year into all nuclear power plants owned by a company ("licensee"). Furthermore, if through a parent relationship one corporation owns several "licensees," the percentage calculated is based on the parent corporation's aggregate nuclear fuel assemblies.

Estimating the impact of this US import usage fee, $100 per kilogram translates into approximately $5 per pound of U_3O_8. Thus, the first level of this import fee ($200 per kilogram) corresponds to about a $10 per pound U_3O_8 price "indifference" between US and non-US uranium. Thus, if US uranium is selling for no more than $10 per pound higher than non-US uranium, a US utility would buy the US uranium to have cheaper overall costs for the 37.5-55 percent of his fuel. For this reason, the import usage fee would result in a two-tiered uranium market price—one tier for non-US uranium and a higher-priced tier for US uranium. This, of course, assumes a competitive market among suppliers and a US uranium industry that cannot supply all US utility needs.

S.2097 contains important "grandfathering" provisions. If the US utility's non-US uranium is obtained under a contract that was entered into prior to September 8, 1986, that non-US uranium is exempt from the fee. In fact, if the grandfathered contract is with a domestic supplier and the contract terms allow the supplier to select the national origin of the uranium to be delivered, the supplier would be allowed to purchase non-US uranium after September 8, 1986, to deliver under that contract and the uranium would still be exempt from the fee calculation.

The grandfathering provision specifically states that it applies to contracts in which the quantity of non-US uranium to be delivered is fixed, and for which the dates of delivery may be flexible. On the other hand, the provision specifically excludes from grandfathering (i.e., includes in the calculation of the usage fee) any non-US uranium delivered under an option exercised or created by an amendment to a contract after September 30, 1986.

It is important to note that the non-US uranium obtained from grandfathered contracts is not treated as US-origin uranium, rather it is merely exempt from the usage fee. Furthermore, it is treated as the first non-US uranium loaded in a given year. For example, if 50 percent of a utility's newly loaded fuel is from non-US uranium, of which 40 percentage points are from grandfathered contracts, the 10 percent from non-grandfathered contracts would be liable for the fee of $200 per kilogram, since it constitutes a marginal fraction in the 40-50 percent non-US range.

Another provision of S.2097 covers the extent to which changes of national origin of uranium (referred to as "flag swaps" in the bill) will be permitted. The definitions section of the bill states that domestic uranium is uranium mined in the USA, including "uranium recovered from uranium deposits in the USA by underground mining, open-pit mining, strip mining, in-situ recovery, leaching, and ion recovery, or recovered from phosphoric acid manufactured in the USA." Any other uranium is deemed non-US uranium.

Under certain circumstances, the national origin (i.e., US versus non-US) may be exchanged between two lots of uranium by the two owners of the lots. If the owners of the lots involved in a transaction have accomplished the transaction in compliance with all applicable regulatory requirements, and if the lots of uranium are at the same location in the custody of a third party (and in actuality or by reasons of the third party's accounting practices the uranium lots are commingled), the transaction would be an allowable way to obtain US-origin uranium for the same quantity of non-US-origin uranium.

Any change in national origin occurring on or before January 1, 1986, would be recognized for purposes of the usage fee calculation, if such origin change is reflected on the first DOE/NRC form 741 applicable to that lot after the origin change. Any origin changes taking place after January 1, 1986, would be allowed if:

1. Equal quantities of uranium, based on the equivalent amount of feed for enriched uranium, were involved in each side of the transaction and there were no increase in the quantities of uranium designated as foreign and domestic;
2. None of the uranium involved had been loaded into a reactor, irradiated, contained in enrichment tails material or other by-product of processing or materials owned by the US Government; and
3. The transaction complied with all applicable regulatory requirements at the time of the transaction.

The Secretary of Energy is required to promulgate, within six months after passage of the Act, regulations governing the characterization of national origin consistent with the purpose of the Act.

The bill also contains provisions to repeal Section 161(v) of the US Atomic Energy Act (as amended in 1964). Section 161(v) requires the US Department of Energy (as the successor to the defunct Atomic Energy Commission) to restrict its enrichment of non-US-origin uranium, to the extent necessary to maintain a viable US uranium industry. The lawsuit filed by several US uranium producers against the DOE (which is currently before the US Supreme Court) focuses on this provision of the law. Finally, the bill also defers the requirement that the Secretary of Energy make a determination each year of the US uranium industry's viability. The Secretary would be required to report such a determination for the years 2000 through 2011.

There has been an attempt to directly link the uranium import provisions of S.2097 to the US-Canada Free Trade Agreement (FTA). In a December 1, 1987 letter from 25 US Senators to President Reagan, the Senators argued that S.2097 (or S.1846 as it was referred to then) repeals Section 161(v) of the Atomic Energy Act and is, thus, consistent with the principles of the FTA dealing with uranium. Furthermore, they argued, S.2097 provides for a phaseout of import restrictions by moderating the import fee schedule in 1995 and totally eliminating the import usage fee after the year 2000. This is consistent with the gradual phaseout in the FTA for other trade barriers, in the opinion of these Senators.

Although there has been no formal response to the December letter, officials within the Administration strongly disagree with the letter's contentions. In the Administration's view, there is no uranium import restriction now; thus, the phaseout argument is ludicrous. The Senators' letter implied that DOE is illegally avoiding the imposition of imported uranium enrichment restrictions, as required, in their opinion and the opinion of two US courts, by law.

TITLE I - URANIUM REVITALIZATION

SEC. 110. DELETION OF SECTION 161v. - Subsection 161v. of the Atomic Energy Act of 1954, as amended, is deleted and the remaining subsections are relettered accordingly.

SEC. 111. AMENDMENT TO SECTION 170B. - Section 170B of the Atomic Energy Act of 1954, as amended, is further amended by deleting "1983" and substituting "2000", by deleting "1982" and substituting "2000", and by deleting "1992" and substituting "2011" in both places it appears.

SEC. 112. IN GENERAL. - Any licensee of a civilian nuclear power reactor with fuel assemblies loaded after December 31, 1987, and prior to January 1, 2001, that contain foreign uranium shall be assessed and pay the charges, to be imposed and collected by the Secretary, as provided in section 113, except as provided elsewhere in this title.

SEC. 113. CALCULATION OF CHARGES. -

(a) The charge to impose by the Secretary pursuant to section 112 shall be, subject to section 115, calculated upon the percentage of foreign uranium included in the aggregate of new fuel assemblies loaded into all of the civilian nuclear power reactors owned or operated by any one licensee or the licensees owned by one corporation during any calendar year as follows:

$0.00/kg on the kilograms of foreign uranium which comprise the first 37 and one-half per centum of the total weight of the uranium in new fuel assemblies loaded in such year.

$200/kg on the kilograms of foreign uranium which comprise the percentage of the total weight of the uranium in new fuel assemblies loaded in such year greater than 37 and one-half per centum, but less than or equal to 55 per centum.

$250/kg on the kilograms of foreign uranium which comprise the percentage of the total weight of the uranium in new fuel assemblies loaded in such year greater than 55 per centum but less than or equal to 60 per centum.

$350/kg on the kilograms of foreign uranium which comprise the percentage of the total weight of the uranium in new fuel assemblies loaded in such year greater than 60 per centum but less than or equal to 70 per centum.

$400/kg on the kilograms of foreign uranium which comprise the percentage of the total weight of the uranium in new fuel assemblies loaded in such year greater than 70 per centum but less than or equal to 80 per centum.

$500/kg on the kilograms of foreign uranium which comprise the percentage of the total weight of the uranium in new fuel assemblies loaded in such year greater than 80 per centum.

(b) (1) For calendar years after December 31, 1994, no charge shall be imposed on the kilograms of foreign uranium which comprise the first 50 per centum of the total weight of the uranium in new fuel assemblies loaded in such year.

(2) There shall be no charge imposed on foreign uranium excluded from the charge by section 115. The foreign uranium excluded from the charge by section 115, shall be deemed the first foreign uranium contained in the aggregate of new fuel assemblies loaded into all of the civilian nuclear power reactors owned or operated by any one licensee or the licensees owned by one corporation during any calendar year for purposes of calculating the charges to be paid under this section.

SEC 114. CORPORATIONS OWNING MORE THAN ONE LICENSEE AND REACTORS WITH MULTIPLE OWNERS. -

If a corporation owns more than one licensee, the percentage of foreign uranium which shall be considered included in new fuel assemblies loaded by each licensee owned by such corporation during a calendar year shall be the percentage of foreign uranium included in the aggregate of all new fuel assemblies loaded during such calendar year into all civilian nuclear power reactors

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owned by such corporation. Where a civilian nuclear power reactor is owned by more than one utility, an owner may, by mutual agreement with the other owners, elect to aggregate the pro rata share of new fuel assemblies in that plant with the pro rata shares of new fuel assemblies loaded in other civilian nuclear power reactors owned or operated by such owner.

SEC. 115. EXCLUSION FROM CHARGE.-

(a) In making the calculation of charges required in section 113, a charge shall not be assessed on foreign uranium that is included in new fuel assemblies loaded in all civilian nuclear power reactors owned or operated by any one licensee or the licensees owned by one corporation during any calendar year if such uranium has been obtained under the terms of a contract for the purchase of uranium entered into prior to September 30, 1986, between the licensee or the corporation owning the licensees of such civilian nuclear power reactors and the supplier, including:

(1) such a contract under which the quantity of uranium to be purchased is fixed but with flexibility as to date of delivery; and

(2) such a contract with a domestic supplier that allows the supplier to select the national origin of the uranium delivered.

(b) Foreign uranium that is included in new fuel assemblies loaded into a civilian nuclear power reactor owned or operated by a licensee or the licensees owned by one corporation during any calendar year shall be subject to the charges assessed on foreign uranium if such uranium was obtained under the terms of contract, executed on or after September 30, 1986, or obtained under an option which was exercised on or after September 30, 1986. The increased quantities of foreign uranium obtained under a contract executed before September 30, 1986, but that is modified or extended after that date to increase the quantity of foreign uranium delivered, shall be subject to the charges imposed by section 113.

SEC. 116. DETERMINATION OF PERCENTAGE. -

The percentage of foreign uranium that shall be deemed to be contained in the new fuel assemblies loaded in a year shall be determined by dividing the weight of Equivalent Foreign Uranium by the total weight of Equivalent Uranium in such fuel assemblies. For the purpose of this calculation, fuel loadings during refueling outages that begin in one calendar year and are completed in the following year may be counted in either year but not both.

SEC. 117. FLAG SWAPPING. -

(a) For purposes of making the certification required under section 119 and calculating the charges imposed under this title, a characterization of the national origin of a particular lot of uranium shall be recognized as provided in this section.

(b) If the national origin of a particular lot of uranium has not been changed from the nation in which it was mined, the nation in which such uranium was mined shall be used for purposes of making the certification required under section 119 and calculating the charges imposed under this title.

(c) Any transaction in which a party tenders uranium having one national origin in return for receipt of uranium having a different national origin shall not be deemed to have involved a change in the national origins of the lots of uranium involved in the transaction if:

(1) the transaction is accomplished in compliance with all applicable regulatory requirements; and

(2) the lots of uranium involved in the transaction are held at the same location in the custody of a third party such that, in actuality or by reason of the accounting practices of the third party, the lots of uranium involved in the transaction are commingled.

(d) If the national origin of a particular lot of uranium has been changed on or before January 1, 1986, from the nation in which it was mined, and such changed origin is shown on a DOE/NRC form 741 applicable to such uranium as of January 1, 1986, or on the first DOE/NRC form 741 executed after that date and applicable to such uranium, then the national origin of such uranium as shown on the first DOE/NRC form 741 reflecting the last change occurring on or before January 1, 1986, shall be recognized for purposes of making the certification required under section 119 and calculating the charges under this title.

(e) If the national origin of a particular lot of uranium has been changed after January 1, 1986, from the country in which it was mined, from the national origin as shown on a DOE/NRC form 741 applicable to such uranium and recognized under subsection (d), or from national origin recognized under this subsection prior to the change in question, such change in question shall be recognized for purposes of making the certification required under section 119 and calculating the charges owed under this title if the change was part of an exchange of national origins that:

(1) to the best knowledge of the owner of the particular lot of uranium, involved equal quantities of uranium, calculated on an equivalent natural uranium basis, with no increase in the quantities of uranium designated as foreign and designated as domestic;

(2) to the best knowledge of the owner of the particular lot of uranium, involved no uranium that has been loaded into a reactor, irradiated, contained in enrichment tails material or other by-product material of processing (including materials lost or unaccounted for) or materials owned by the United States Government; and

(3) complied with all applicable regulatory requirements at the time of the exchange, including regulations promulgated under subsection (f).

(f) The Secretary shall promulgate regulations within six months after the date of the enactment of this title that, to the extent reasonable and practicable, ensure that the purposes of this title are realized in the characterization of the national origin of uranium under this section.

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(g) For purposes of this section, the term "uranium" shall include natural uranium and natural uranium equivalents.

SEC 118. DISPOSITION OF CHARGES. -

The charges imposed by this title, and collected by the Secretary, shall be deposited within sixty days after the certification required in section 119 in the general fund of the Treasury of the United States as miscellaneous receipts.

SEC. 119. CERTIFICATION. -

The owner or operator of any civilian nuclear power reactor must certify to the Secretary by March 1 of each year the following information for the previous calendar year:

(a) the total weight of uranium in new fuel assemblies loaded during such year;

(b) the total weight of foreign uranium included in new fuel assemblies loaded during such year;

(c) the total weight of foreign uranium included in new fuel assemblies loaded during such year which is excluded from the charge pursuant to section 115;

(d) the total weight of domestic uranium included in new fuel assemblies loaded during such year;

(e) the isotopic enrichment assays and tails assays employed in ordering enriched uranium used in the respective fuel assemblies during such calendar year; and

(f) the equivalent natural uranium for each quantity of enriched uranium reported.

SEC 120. GOVERNMENT URANIUM PURCHASES.

(a)(1) After the date of enactment of this Act, the United States of America, its agencies and instrumentalities, shall not enter into contracts or orders for the purchase of uranium other than for domestic uranium: Provided, that this section shall not affect purchases under a contract for delivery of a fixed amount of uranium entered before the date of enactment of this Act, or options exercised for fixed amounts prior to the date of enactment of this Act.

(2) The use of natural uranium contained in stockpiles or inventories owned by the United States, including its agencies and instrumentalities, shall be restricted to military purposes and Government research and to overfeeding and pre-production of enriched uranium by the United States Enrichment Corporation. The amount of natural uranium together with the amount of natural uranium equivalent of enriched uranium contained in stockpiles or inventories owned by the United States, including its agencies and instrumentalities, as of the date of enactment of this title shall, to the extent practicable, not be reduced except for military purposes, overfeeding, or Government research purposes.

(b) Subsection (a) shall not apply to the Tennessee Valley Authority.

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A PROGRAM FOR PRESERVING AND ADVANCING NUCLEAR POWER IN THE USA

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Mr. Wolcott, the former Chairman of Nuexco, is now Chairman of the Nuexco/Concord International Advisory Committee. Mr. Wolcott's views, as outlined in this essay, are set forth to stimulate thought and discussion, and do not necessarily represent those of Nuexco.

In this essay, Mr. Wolcott expands on the theme that he first developed in an earlier paper entitled A National Strategy For Nuclear Power *(Report 229, September 1987). In these papers Mr. Wolcott presents the thesis that, on one hand, the incentive structure presently provided by the government is such that a US nuclear industry will not arise again, even though national needs may require it. On the other hand, even if positive government support were to emerge, the industry is not conceptually organized to respond to the social, economic, political, and environmental forces — in other words, the real market.*

Mr. Wolcott's previous paper dealt with a general strategy for meeting real market needs, which are much different than those prevailing at the time the concepts now in use evolved. To fill part of the need, a large-scale prototype program was proposed to overcome anachronistic conditions and to prepare for a "Second Era."

Among other things, the program called for construction of two large prototype (but nevertheless commercial-sized) light-water reactors, two reactor facilities for technology demonstrations, and one integrated fuel cycle project. The Idaho National Engineering Laboratory was proposed as the most advantageous site in the USA. This paper expands on the rationale for that prototype program.

Introduction

In the USA, utilities are very unlikely to begin ordering any new nuclear plants for use before the year 2000. Too many obstacles currently exist. On the other hand, long-term influences ultimately will force construction of more nuclear units. The problem is whether to do nothing now, and wait until economic forces dictate action, or begin meaningful preparations for the future.

Approximately 100 nuclear plants currently are operating in the USA and another dozen will start up within the next few years. Completion of those plants will mark the end of new startups for more than a decade to come. Many nuclear facilities have already operated for 10 to 20 years, and in some cases longer. While the average operating lifetime of nuclear stations has yet to be determined, 30 to 50 years is usually assumed. Therefore, as plants age, decommissioning will be necessary and the number of operating units will steadily decline. Nuclear energy production will peak (after new startups) at approximately 20 percent of total national electricity production and, as decommissioning accelerates, will decline towards zero during the first few decades of the next century.

All types of power plants age and must eventually be replaced. Furthermore, even taking into account modest growth and ever improving conservation, increasing demand will require the building of several hundred new electrical generating facilities during the next several decades. What types of generating plants will be built is not clear. Will coal satisfy all our needs? Most unlikely. Oil? Out of the question. Natural gas? A share. Hydro? Few new dams will be built. Passive energies, such as solar? A minor fraction. Do without nuclear power? Most unlikely.

The Need for a Fresh Start

One might reasonably ask why, after building and operating over 100 nuclear plants, dominating the overseas reactor market for 20 years, and providing technology for most other nations' domestic nuclear industries, should the USA consider a prototype program? The answer has to do with the clearly foreseeable gap in nuclear plant construction. Under present conditions, no new nuclear plants are being started. However, at the end of a 10 or 20 year period, a growing need may force a rapid expansion in nuclear construction.

An industry that must grow, and may grow rapidly in the future for reasons of national self-interest, deserves investment and preparation. Old designs will not satisfy tomorrow's market. Concepts developed in the 1960s and 1970s have been modified and modified again to meet regulation after regulation. Complexity has been piled on complexity. As a result of this chaotic situation, many observers have

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concluded that a high degree of standardization must be applied in the future.

In the USA, technology has continued to advance, but largely in conceptual terms. Improved safety, reduced cost, increased reliability and shorter construction schedules all are possible, but they are most likely to be assimilated in one or two, not several, design types. To attempt to test new technology without a prototype as a model would merely repeat the experiences of the past 15 years.

It is unlikely that a utility would commit to build a plant whose design has not been proven. Even a management willing to do so would find that regulatory organizations, consumers, and investors would make it most difficult. All such groups would want a way of allowing careful estimates of regulatory risk, safety, cost, and schedule.

A sound approach to the future requires understanding the past. One study, published in July 1987, analyzed 113 US nuclear plants to determine why costs and schedules had increased so dramatically. The study's conclusions included the following:

1. Between 60 percent and 80 percent of recent plant costs are due to the direct and indirect impact of regulations.
2. Costs of plants started after September 1970, increased at an annual compound rate of 17.7 percent (some 10 percentage points above the rates for monetary inflation alone) while labor and material quantities required have grown approximately 10 percent per annum.
3. Doubling of plant size increases cost by only 50 percent.
4. Each additional year of construction time increased costs by 14.7 percent.
5. Costs for similar plants in various regions varied as much as 50 percent; the highest costs were in southern California and the northeast central areas. Regional location also affects how long plants have taken to build.
6. US-design reactors built elsewhere in the world cost far less than they do when built in the USA.
7. In one situation, two similar reactors were built in the same area. The first was completed in 1976 for $460 million and the second in 1983 for $3.4 billion. The latter required twice as much concrete, large pipe and cable, and 6 times more electrical conduit. The first plant was completed in five years, and the second in eleven.

Scope of a Prototype Program

The program proposed in this essay may not be precisely described by the term "prototype", as used in a conventional sense. The program would actually involve two commercial-size power generating plants, as well as two development-oriented reactor units, and a general purpose back-end fuel cycle project. The program would serve separate, but complementary, purposes.

1. Two light-water reactor projects should be built by competing suppliers. One might be a boiling water reactor (BWR) and the other a pressurized water reactor (PWR), or the BWR or PWR might be used for both prototypes. The result, in either case, should be two competing *standard* designs. Plants should be built in the same area and constructed and operated under similar conditions for comparison. Sizes should be in the range of 300 to 900 MWe (maybe larger if economics requires) so as to serve effectively as standardized models and as actual power-generating facilities.
2. Another facility should be a High Temperature Gas Reactor (HTGR). HTGR development programs have continued for many years. A next, and major, step is needed, otherwise research and development may pass the point of diminishing returns. If this next step aims to produce a standardized design, a large module may be in order — up to several hundred megawatts of electric capacity. If the prototype merely aims to provide technology for a standardized design to follow, a small unit may be preferable.
3. The Integral Fast Reactor (IFR) is in a stage of development comparable to that of the boiling water reactor in the mid-1950s. The primary concerns now are determining more of the unique potential for inherent safety, fuel and fission products recycling, nonproliferation protection, and others, as they might apply to a commercial unit. Those considerations suggest a prototype in the 50- to 150-MWe range, or possibly only a reactor without electrical power generation.
4. An integrated fuel cycle program should aim to minimize stored waste, returning fuel and fission products to the reactors for recycling, and lessening radioactive waste shipments.

These development programs are complementary in time and purpose. The light-water reactor program has relatively short-term goals and can take advantage of the vast background of experience and technology. The HTGR, considerably less developed, could be a later competitor to

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light-water reactors. The IFR is a project whose technology, once proven, may provide a number of advantageous solutions for the longer term. The fuel cycle program serves the needs of all types of reactors in varying degrees. Finding solutions to the problems currently besetting today's nuclear power program will help to lessen, and hopefully remove, some psychological obstacles to nuclear power.

Comparisons with Japan

The USA and Japan have had a long, mutually profitable relationship in the field of nuclear power. Until a few years ago, nuclear commerce between the two countries followed an established pattern. The first units were developed, manufactured, and used in the USA, after which Japanese suppliers purchased the designs. The next step usually involved participation in joint projects, and was followed by Japanese manufacture of components under license. The pattern was repeated each time the American company introduced a significantly advanced model.

This pattern is changing and with it the role of leader. Japan's nuclear program is advancing and the US program is not. Japan respects US assistance and purchases engineering services and specialized manufacturing, but the lead now is being taken by Japan. The Japanese national program includes the following:

1. Continuing construction of proven reactor types in large-scale nuclear power sites.
2. Construction of two 1,300-MWe advanced BWRs with features for improved safety, reliability, and economics. The concept was largely a blending of American, Swedish and Japanese technology. The project is being conducted for Tokyo Electric Power Company (TEPCO) the world's largest private utility, for operation in the early to mid-1990s. Toshiba and Hitachi are the main Japanese suppliers, and General Electric Corp. (GE) is a subcontractor.
3. Kansai Electric Power Co. is constructing one or more advanced PWRs with similar features, for operation in the 1990s. Kansai is the owner. Mitsubishi Heavy Industries is the Japanese supplier, and Westinghouse is a subcontractor.
4. A Japanese company is expected to support another advanced boiling water reactor concept for a 600-MWe unit known as the SBWR (Simplified Advanced Boiling Water Reactor). Among its attractive features are "inherent safety," natural coolant circulation, and design simplicity. The original concept was developed by GE.
5. There are a variety of programs in which government and industry cooperate to advance development of fast breeder reactors, enrichment, waste disposal, and fuel cycle technology and applications.

Subcontracting to the Japanese program is extremely helpful to US firms and to the US program. *Suppliers in the USA are receiving more advanced light-water reactor support from Japan than from all US sources combined,* including DOE, the Electric Power Research Institute, utilities, and suppliers. Without that support, the USA would have little more than a paper program.

Japan has, or soon will have, about a 10-year lead in nuclear technology over the USA. If present trends continue, by the year 2000, Japan will have at least two advanced PWRs and two advanced BWRs in operation. Several more will be under construction. The USA will have none. The new SBWR prototype, and possibly a pressurized water reactor equivalent, also may be in operation in Japan. Japan will then lead the USA by two full models, both incorporating advanced safety and other features US users could not forego in any future ordering.

Nothing in the foregoing should be construed in any way as a criticism of Japan. Japan is doing the right things, even to the extent of helping the US industry. The USA is doing very little and in some cases the wrong things. Credit deservedly belongs to those who make the effort and investment to prepare for the future.

Use of the Idaho National Engineering Laboratory (INEL) As a Program Site

In choosing a site for a prototype center, several important requirements must be considered.

1. Use of an already established operation minimizes delays in the selection process;
2. A desirable site should already have facilities available to allow an efficient use of funds;
3. The site should have trained personnel available for expansion;
4. It should be located in a receptive community;
5. It should be assured of support by state and local governments;

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6. It should be located in a relatively unpopulated area to minimize concerns some may have about proximity of nuclear stations to population centers.

Three possible sites appear most favorable for a prototype program — the Hanford Reservation in Washington state, the Savannah River Complex in South Carolina, and INEL in Idaho. Each meets the foregoing requirements in varying degrees. The ill-fated Washington Public Power Supply System (WPPSS) program has left the attitudes of the public, and the state government in Washington, ambivalent towards nuclear development. Savannah River has specialized for nuclear weapons material production and is not known as a development center.

INEL has a large land area, and is located in a zone of modest population. Southeast Idaho provides a receptive community. Local, state and federal officials there are actively seeking new nuclear industry. INEL has development and operations experience of the type needed, and a substantial, reputable organization of trained personnel is available. Construction costs in Idaho are relatively low. A project may be affordable in Idaho where it would not be elsewhere. Future expansion can be accommodated. Power can be used locally and exported. In short, INEL offers substantial advantages.

The Need for Government Leadership

Strong government leadership is required if the US nuclear program is to be made viable. The leadership cannot come from industry, as much of it once did, and utilities are too cautious now to pursue a risky course. Even discussion of potential safety advancements, for example, may only encourage adding regulations and provide ammunition by those more interested in erecting obstacles than in making progress.

Self-imposed restraints further hamper aggressive industry leadership. The December 29, 1987, *Wall Street Journal* contained an article entitled "Nuclear Power's Secret" by Mr. Peter Beckmann, a professor emeritus of electrical engineering of the University of Colorado. His message is that "the nuclear power industry has been hiding a big secret"— namely that nuclear is far safer than coal. "The short answer," Professor Beckman argues, "is that its biggest clients, the utilities, mostly use fossil fuels, especially coal, and the nuclear power industry is loath to offend its potential customers. There is a well-kept truce between the nuclear industry and coal lobbies and neither wants to play up one against the other. Each has enough enemies as it is."

The further development of nuclear energy serves national interests (and therefore government interests) far more than industry interests. Industry will respond to a policy framework, but it cannot create that framework. The federal government, with its responsibilities for the environment, oil imports, long-term national fuel supply, etc. must provide those policies, for they are beyond the scope of any company.

One government option — the option currently being followed — is to do very little, believing that time and events will dictate the solution. The nation can wait until action is demanded, but there is the danger that waiting will only create new problems without any new solutions. What conditions are likely to prevail in a crisis situation? Will an oil crisis force overly rapid expansion? Will obsolete designs be used? Must we wait a decade or two before developing, constructing, and testing standardized plants? Or will standardization be waived in the interests of expediency? Will potential buyers of nuclear plants turn to overseas suppliers? These are a few of the many questions government would do well to consider in deciding whether, when, and how to act. And if preparatory action is to be taken, what conditions must government provide to restore innovation and investment?

Cultivating Public Support

In a report by the Committee For Energy Awareness, polls by Gallup and Cambridge Reports indicate that the public believes that the nation already depends about equally upon nuclear and coal (In fact, nuclear provides 18 percent of total electrical power and coal more than 55 percent.); that nuclear will be more important than coal in ten years (In fact, new startups beyond the few under way will not take place in the next ten years.); and that nuclear will become more important in the future. (In fact, decommissionings will gradually reduce market share.) More than two-thirds of the general public and an overwhelming majority of technical and scientific personnel support those positive views. Despite the positive views, however, less than one-fifth favor a nuclear plant in their area. This reservation must be accommodated by nuclear users whether they believe such a view is justified or not.

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A government attempt to initiate a nuclear restart involving a number of simultaneous new orders, such as occurred in the 1960s, would fail. It is doubtful that even one utility would respond without major changes in inducements as compared to those which exist. Years would be required for the approval of new locations. Industry must reshape to meet known public concerns and market conditions. If cities do not want nuclear plants nearby, we should build in receptive and sparsely populated areas. If the public wants the perception that more safety is being provided, we must make that a major design objective. If the public wants a clean environment, we must capitalize on nuclear power's intrinsic advantages. But we must adapt to these forces, and the change will take time and effort.

Energy is not a major part of today's political agenda. Presidential candidates appear uninterested or uniformed, or both. Pressure does not appear to be building for near-term use of nuclear power. However, productivity is gaining importance, and discussions of productivity lead to discussions of energy, and discussions of energy lead to discussions of nuclear power. When public interest reaches that point, government may once again find it desirable to have a strategy that takes account of public perceptions.

Meeting the Cost Challenge

Cost of the total prototype program will exceed the ultimate value of the facilities when used for power generation. That is because much of the work will be for research and development, but the benefits will be long term. The program actually has several categories, each of which has different cost and financing problems.

1. Light-Water Reactors — The two proposed reactor designs will be completely new. Engineering, manufacturing, construction, and startup costs will be higher than if those were spread over several identical plants. Ultimately, both plants will become permanent commercial generating units and will have high value. That value may not, however, be equal to the cost. Much depends upon the size chosen for the units. The larger the size, the more economically competitive they will be.

2. Integral Fast Reactor — Small-scale tests have been performed at INEL, but much more development will be needed before a major power producing station can be built. Much additional information is needed to evaluate the economics, safety, and general feasibility. All of the costs involved in building the proposed prototype program would be incurred for research and development. No worthwhile power generation is expected.

3. High Temperature Gas-cooled Reator (HTGR) — The HTGR is between the water reactors and the IFR in maturity. Although a 330-MWe plant was built in Colorado over 10 years ago, and development has continued since that time, the current need is for a standardized design that would serve as the model for a number of later plants. An intermediate step may be desirable which would provide added knowledge and experience from which a standard design might then be produced. One may expect that substantial costs for research and development and prototype construction will be incurred.

4. Fuel Cycle Project — A considerable amount of work has been done on the back end of the fuel cycle. However, the knowledge obtained needs to be integrated and applied to specific reactor projects (much as has been conceived for the IFR). Any system constructed would be capable of commercial use, and although being the first-of-a-kind would entail costs beyond normal, the residual value would be substantial.

It is difficult to estimate what a program of this magnitude would cost at this time, for much depends upon how the project is organized, the size of plants, electricity produced, where construction would take place, etc. One can, however, summarize typical amounts often associated with such projects. Representative figures might be as shown in Table 2.

For the above program to be built within a reasonable cost framework assumes a fresh start, that government will not turn the program into a "pork barrel," and that industry will not turn the program into a "boondoggle." It further assumes no unreasonable delays due to judicial or political activity. In essence, it is assumes project execution much as at the start of the First Era, that is, in the 1950s and early 1960s. The probable shortfall of even several billion dollars is not unreasonable if spread over ten years.

Some possible ways of keeping the costs manageable include the following:

1. Utilize an existing federal site with reasonable construction costs and one which does not have a history of politically motivated delays;

2. provide federal government land, infrastructure, and support services without cost to investors;

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Table 2

COSTS OF PROPOSED PROTOTYPE REACTOR PROGRAM

	Cost ($billions)	Power Value*
Two 600-MWe Light-Water Reactor Plants	2.5	1.8
HTGR	0.5	0
Integral Fast Reactor	0.5	0
Fuel Cycle Project	1.5	0.5
Total Cost	5.0	
Total Power Value	2.3	
Shortfall of cost less power value	2.7	

*"Power Value" assumes value only for final electricity production and does not include value for research and development.

3. obtain support from domestic and overseas contributors in return for rights concerning technology, experience, training, etc;
4. provide government financial support similar to that used in the late 1950's and early 1960s;
5. provide oil-saving tax credits similar to those available for ethanol. A large nuclear plant saves 10 million barrels of oil per year. The cost in foreign exchange for two large oil fired stations is 300 to 400 million dollars per year. (Imported uranium, by comparison, would cost about 16 million dollars per year, or about one-twentieth of the cost of oil.) A tax break comparable to that available for ethanol would make light-water reactor plants highly profitable.

Ownership and Financing

The maximum practical amount of private financing and private ownership would be desirable for the proposed program. This would be mainly in the light-water reactor and HTGR categories, but means might be found to extend such ownership to other categories.

The light-water reactors would be built and operated with the intention of becoming permanent commercial generating stations. They could be privately-owned by generating companies. Power from two medium-sized nuclear plants would exceed that of many small utilities. The plants' value would be several hundred million dollars per year. In the event private investment is not forthcoming, the strategic need for the program would justify the government proceeding alone even though that is not the most desirable course.

Summary of the Results to be Achieved

Completion of the proposed program would produce the following results:
1. Two fully licensed, standardized, advanced designs as a basis for larger scale use when required;
2. operation of a major commercial power generating center with a capacity of 1,000 to 2,000 MWe;
3. the advantages and disadvantages of the HTGR would be better established;
4. the Integral Fast Reactor concept, technology, and potential would provide concrete results for evaluation, and a basis for the next step;
5. public obstacles associated with the nuclear power waste system would be alleviated;
6. a pattern would exist for the subsequent construction, evaluation, and licensing of advanced designs;
7. a national center would exist specifically for leading the way in the advancement of commercial nuclear power;
8. the USA would hold a position in commercial nuclear power comparable to other leading nations.

Conclusion

The chaos of the latter part of the first nuclear power era, now nearing an end, was not inevitable. Nor is a phase-out of nuclear power in the USA early in the next century inevitable, as trends would indicate. The interplay of many forces will not allow the industry to disappear.

But correcting past mistakes and preparing for future requirements will not result from maintaining a status quo. Without action, the next nuclear era will always be 10 to 15 years into the future, until the pressure of events forces society to choose only the most expedient options. Should that happen, the cost of our lack of preparation would be enormous. Repeating in the Second Era even some of the mistakes of the First Era is unthinkable. Although launching a Second Era presents many challenges, they are small compared to those to be expected if the future is left to chance. And if the Second Era looks difficult, consider the problems of future generations attempting a Third Era if the Second is mismanaged as badly as the First.

The case for advance preparation appears overwhelming. Time is available, the cost is affordable, and public support can be obtained. A bold program, such as this one admittedly is, will no doubt be criticized by some as lacking feasibility, too large, etc. But twenty years ago such a program would have appeared modest. Thinking small may be easier, but it will not solve a large problem. Creeping along, nibbling at big challenges, will not produce results in proportion to need. Moreover, the USA functions best in bold undertakings and in the long run those have the greatest chance of success. Patience is soon lost in long-term activities which have little appeal to the imagination.

A new administration will take over in 1989. The "energy problem" will surface again sooner or later, perhaps as it did only a few years back, and a strategy for coping with it will have to be considered at some point. An old political maxim says that "If all else fails, do the right thing." That just might happen to nuclear power with a little nudging in the right places.

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SOUTH AFRICA

First quarter 1988 output from Chamber of Mines producers totaled 2,499,000 pounds U_3O_8, a 1.3 percent increase from the fourth quarter of 1987. Minor production increases by Driefontein Consolidated, ERGO, Chemwes, Vaal Reefs and Western Areas were almost offset by minor decreases in production at Bufflesfontein, Freegold, Harmony, Hartebeestfontein and Randfontein. These production figures are more in line with the production levels that existed prior to last year's strike difficulties with the National Union of Mineworkers.

Total production for South Africa in 1988 is expected to increase slightly from the 1987 level of 10.3 million pounds U_3O_8, because the miners strike was resolved.

Table 3
REPUBLIC OF SOUTH AFRICA
RECENT URANIUM PRODUCTION[1]
(Thousands of Pounds U_3O_8)

Operation	**Second Quarter 1987**	**Third Quarter 1987**	**Fourth Quarter 1987**	**First Quarter 1988**	**Percent Change[2]**
Buffelsfontein	245	240	229	214	- 6.7
Driefontein Consolidated	41	42	36	40	+12.2
ERGO[3]	79	85	93	104	+12.2
Freegold[4]	245	223	277	257	-7.4
Harmony	103	97	90	88	-1.2
Hartebeestfontein	231	223	219	212	-3.2
Randfontein	297	148	259	249	-4.1
Stilfontein (Chemwes)	234	232	239	255	+6.7
Vaal Reefs	977	768	927	977	+5.4
Western Areas	104	124	98	102	+4.3
TOTAL[5]	2,555	2,184	2,467	2,499	+1.3

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[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.

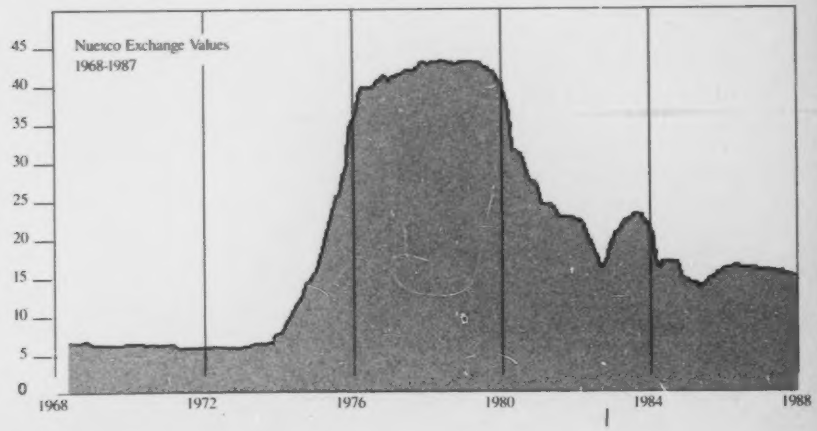
[2] Change in percent from the fourth quarter of 1987.

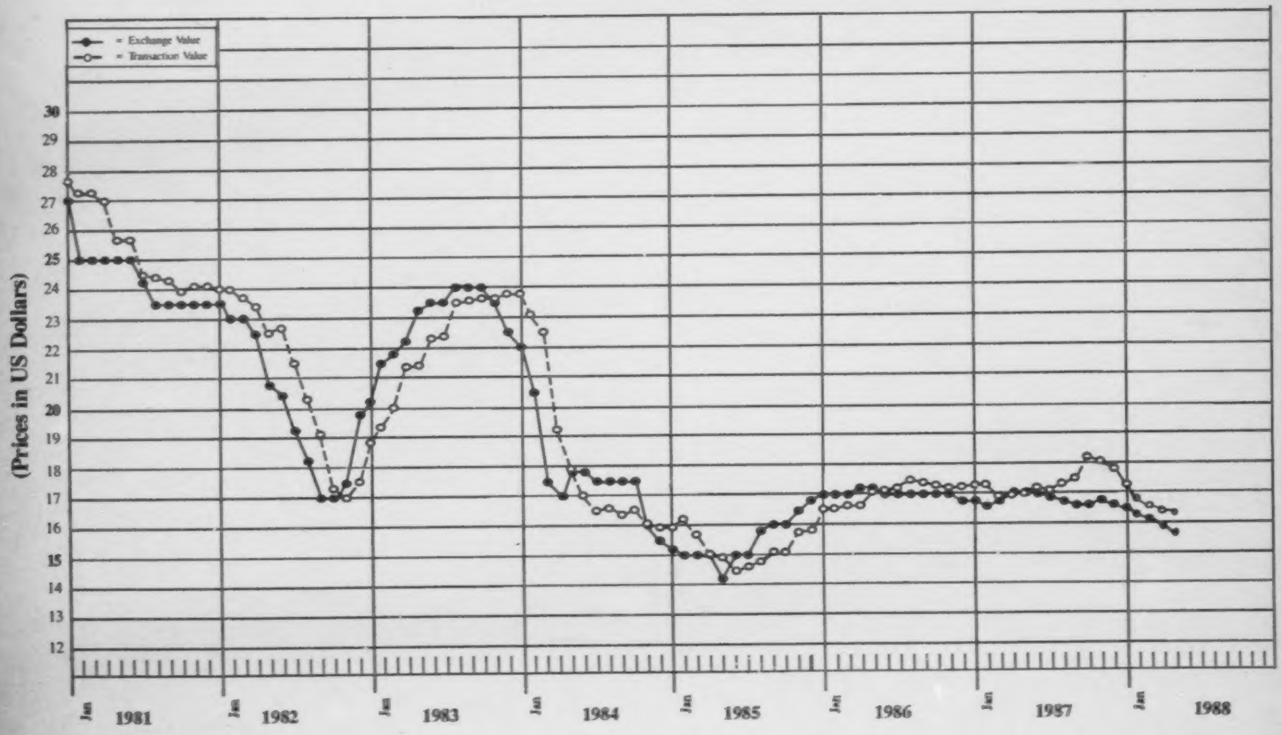
[3] ERGO = East Rand Gold and Uranium Company Ltd.

[4] Formerly Free State Joint Metallurgical Scheme.

[5] Columns may not add up due to rounding.

HISTORICAL MARKET DATA





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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	**15.75**								

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	**.25**								

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	**16.45**								

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF₆)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	[illegible]	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	**1.80**								

HISTORICAL UF₆ VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF₆)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	**45.25**								

HISTORICAL US UF₆ PREMIUM (Relative to the UF₆ Value)

Determined as of the last day of the month indicated ($US/kg U as UF₆)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	**0.50**								

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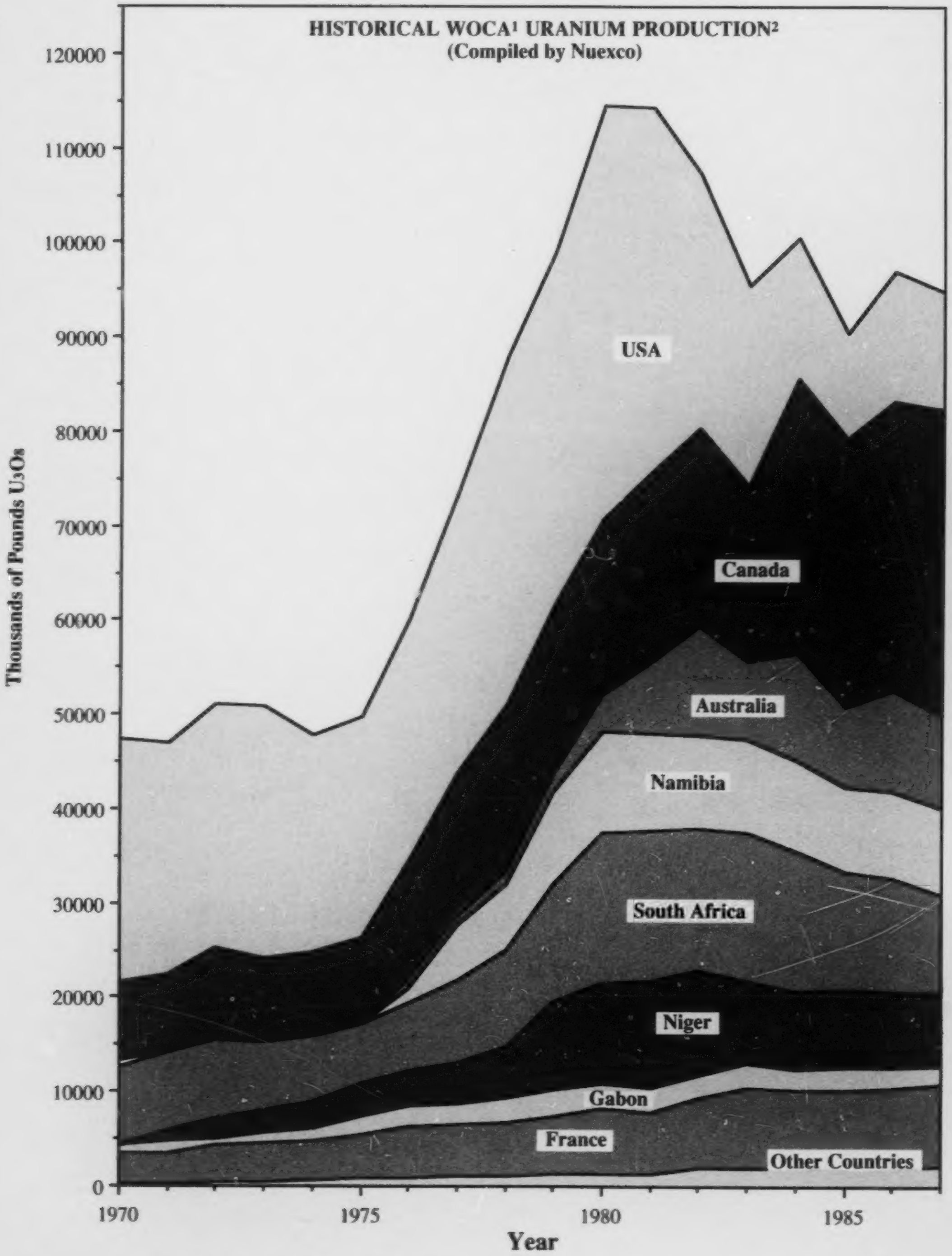
HISTORICAL MARKET DATA



HISTORICAL WOCA[1] URANIUM PRODUCTION[2]
(Compiled by Nuexco)

[1] WOCA = World Outside of Centrally-Planned Economic Areas.

[2] 1987 production data are preliminary.

US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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HISTORICAL MARKET DATA

VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]

(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

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[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	202.7
1986	Avg.	155.5	101.5	213.0
1987	Avg.	—	108.9	—
Jan	1987	—	106.2	215.9
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2
Apr	1987	—	108.3	222.2
May	1987	—	108.1	222.0
June	1987	167.2	108.1	222.2R
July	1987	—	108.7	222.5R
Aug	1987	—	110.5	222.2R
Sep	1987	170.0	109.3	222.8R
Oct	1987	—	108.6	223.0
Nov	1987	—	110.0	222.6
Dec	1987	172.9	111.9	—
Jan	1988	—	112.4	—

P = Preliminary R = Revised since last month

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[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

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GOVERNMENT STATISTICS

CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.1	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.5	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1	140.4	20.47	17.50	16.50	12.63	13.53
Dec	1987	125.5R	140.5	20.62	17.31	16.37	12.54	13.75
Jan	1988	126.2R	140.8	20.70R	17.54R	16.65R	12.82R	13.73R
Feb	1988	125.7R	141.3	20.94P	17.86P	16.96P	13.05P	13.71P
Mar	1988	125.9	142.0	—	—	—	—	—

P = Preliminary   R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975 Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976 Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977 Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978 Avg.	27.14	—	40.3	74.3	658,261	1,502,975
1979 Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980 Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981 Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982 Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983 Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984 Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985 Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986 Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987 Avg.	—	—	137.7	246.8	—	—
Jan 1987	—	—	128.9	233.9	750,496	529,682
Feb 1987	—	—	130.3	237.0	758,230R	600,258R
Mar 1987	88.17	197.1	132.4	239.6	763,003R	536,033R
Apr 1987	—	—	134.1	242.5	765,309R	535,876R
May 1987	—	—	135.6	243.6	761,026R	531,732R
Jun 1987	90.74	203.5	136.6	244.9	763,319R	571,407R
July 1987	—	—	138.2	246.8	764,810R	624,954R
Aug 1987	—	—	140.2	249.9	761,338	564,387
Sep 1987	100.79	224.7	142.0	252.4	742,417	587,707
Oct 1987	—	—	143.6	255.5	725,599	599,116
Nov 1987	—	—	144.8	256.3R	734,630	616,725
Dec 1987	100.34	267.0	145.9	258.3	712,896	613,262
Jan 1988	—	—	147.2	261.5	—	—
Feb 1988	—	—	148.2	—	—	—
Mar 1988	—	—	150.2	—	—	—

P = Preliminary R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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GOVERNMENT STATISTICS

UNITED STATES

		Producer Price Index[1]				Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	Consumer Price Index[2] (1982-1984 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	111.2	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	114.1	13.20	13.49	11.98	9.65
1987	Avg.	102.6	102.8	113.6	—	—	—	—	—
Jan	1987	100.4	100.5	111.2	—	12.94	12.98	12.18	9.84
Feb	1987	100.8	101.0	111.6	—	12.99	12.83	12.21	9.84
Mar	1987	101.1	101.2	112.1	116.1	13.04	12.79	12.24	9.84
Apr	1987	101.6	101.9	112.7	—	13.16	12.90	12.30	9.82
May	1987	101.9	102.6	113.1	—	12.97	12.92	12.31	9.83
Jun	1987	102.4	103.0	113.5	117.2	13.05	12.93	12.27	9.84
Jul	1987	103.1	103.5	113.8	—	13.06	13.07	12.37	9.89
Aug	1987	103.7	103.8	114.4	—	13.03	13.07	12.34	9.90
Sep	1987	103.5	103.7	115.0	117.8	13.19	13.44	12.56	9.98
Oct	1987	104.0	104.1	115.3	—	12.96	13.06	12.52	9.95
Nov	1987	104.2	104.2	115.4	—	12.89	13.10	12.56	10.00
Dec	1987	104.1	104.1	115.4	118.7	12.78	13.14	12.62	10.05
Jan	1988	104.3	104.5	115.7	—	13.02	13.00	12.56	10.03
Feb	1988	104.4	104.6	116.0	—	13.09P	12.91P	12.54P	10.04P
Mar	1988	104.7	104.9	116.5	119.4	—	—	12.52P	10.09P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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NUEXCO REPORT 237 FIGURES OF THE MONTH (April 30, 1988)	This Month (Report 237)	Last Month (Report 236)	12 Months Ago (Report 225)
Exchange Value ($US per pound U_3O_8)	15.75	15.90	17.00
US Premium for the Exchange Value ($US per pound U_3O_8)	0.25	0.15	1.50
UF_6 Value ($US per kg U as UF_6)	45.25	45.50	48.00
US Premium for the UF_6 Value ($US per kg U as UF_6)	0.50	.50	3.00
Transaction Value ($US per pound U_3O_8 equivalent)	16.45	16.55	17.00
Loan Rate (Per Annum)	3.5%	3.5%	3%
Conversion Value ($US per pound U as UF_6)	1.80	1.80	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	5.6	6.0	4.5
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	1.2	2.5	.6
Near-Term Supply-Demand Ratio	4.8	2.4	7.8
Recent Uranium Sales:[3]			
Number of Transactions	1	12	10
Quantity of Material (Millions of pounds U_3O_8 equivalent)	<0.3	12.6	4.1
Nuexco SWU Value: ($US per SWU)			
at 0.3 percent tails assay	68	70	77
US DOE SWU Prices: ($US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6[8]**:** ($US per kg U as UF_6)			
2.5 w/o U_{235}	414	421	455
3.0 w/o U_{235}	529	539	582
3.5 w/o U_{235}	646	658	711
4.0 w/o U_{235}	765	779	842

---

[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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EXECUTIVE SUMMARY
REPORT 237
(All data as of April 30, 1988)

Exchange Value
\$15.75, down \$0.15

The **Exchange Value** is **\$15.75** per pound U_3O_8, down \$0.15 since last month. The US Premium (relative to the Exchange Value) is \$0.25, up \$0.10 since last month.

UF_6 Value
\$45.25 down \$0.25

The **UF_6 Value** is **\$45.25** per kg U as UF_6, down \$0.25 since last month. The US Premium (relative to the UF_6 Value) is \$0.50, unchanged since last month.

Transactions

One recent natural uranium sale is reported, involving **less than 300,000** pounds equivalent U_3O_8. This sale involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **5.6 million** pounds U_3O_8 equivalent, down 400,000 pounds since last month. Active spot and near-term **uranium demand** totals **1.2 million** pounds, down 1.3 million pounds since last month. The spot and near-term **supply-demand ratio** increased to **4.8 to 1**.

Transaction Value
\$16.45, down \$0.10

The **Transaction Value** is **\$16.45** per pound U_3O_8, **down \$0.10** since last month. The calculation includes 25 transactions involving a total of more than 3.3 million pounds U_3O_8 and equivalent UF_6 and covers a period of 5 months.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged. No loan transactions are reported.

Conversion Value
\$1.80, unchanged

The **Conversion Value** is **\$1.80** per pound U as UF_6, unchanged since last month. There is no active secondary market supply for conversion services this month. Active demand totals 750,000 pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value \$68,
down \$2

The **SWU Value** at .3% tails assay is **\$68** per SWU, down \$2 since last month. One secondary market SWU transaction is reported this month, involving less than 50,000 SWU.

* * *

Sweden

Sweden's government introduced a bill scheduling the first two nuclear plant closures as part of a 1980 referendum vote to phase out nuclear power by the year 2010.

United States

The Supreme Court held a hearing on the US Producers vs. DOE lawsuit on April 27, 1988. The Court's line of questioning raised the possibility that it might be remanded back to the lower courts for additional review.

Analysis and Commentary

The US Senate passed the Uranium Revitalization, Tailings Reclamation and Enrichment Act on March 30, 1988. This article discusses Title I of the Bill, which contains provisions restricting the import of foreign uranium, and Title I is reprinted in its entirety.

Essay

Mr. J.R. Wolcott, former Chairman of Nuexco, expands on the theme he first developed in an earlier paper entitled *A National Strategy for Nuclear Power.* His premise is that to ensure its survival in the future, the US nuclear industry must initiate a "Second Era" by developing a large-scale reactor prototype program and by organizing to promote public and government support.

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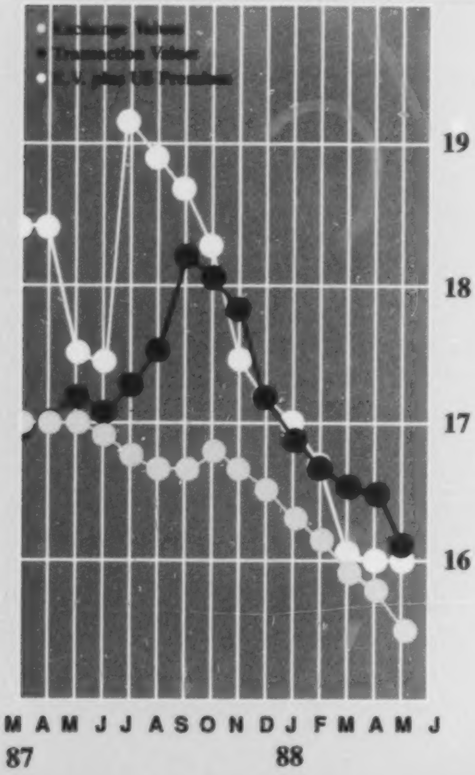

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

June 1988 No. 238

R. GENE CLARK, *EDITOR* FRANCE A. HEAD, *ASSOCIATE EDITOR*

PRICING

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PRICING

May 31, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE[1]	**$15.40**lb U_3O_8	6,990[2]	910[2]
US Premium[7]	**$0.60**		
UF_6 VALUE[2]	**$44.75**/kg U as UF_6	6,990[2]	910[2]
US Premium	**$1.00**		
CONVERSION VALUE[3]	**$1.80**/lb U as UF_6	0	750
SWU VALUE[4] **0.3 tails assay:**	**$68**/SWU	265	111
LOAN RATE[5]	**3.5%**/annum	6,600	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE[6]	16.10	2.6	21	5

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.
[2] For either uranium concentrates or uranium hexafluoride.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of May 31, 1988)

Overall market activity increased in May, and approximately 1.5 million pounds U_3O_8 equivalent changed hands. The SWU market was unusually active with two low-enriched uranium sales and one secondary market SWU sale. Three UF_6 and two conversion transactions are also reported. The U_3O_8 market was quiet, however, as only one transaction took place.

The **Exchange Value** is **$15.40** per pound U_3O_8, down $0.35 since last month, as offers by several non-US sellers at below-market prices failed to motivate buyers. Only one U_3O_8 transaction is reported this month, involving less than 300,000 pounds of US-origin material. At the end of the month a European utility was close to finalizing the sale of a medium-sized lot of concentrates. Demand for non-US concentrates remains highly discretionary. Sellers are having to discount prices substantially to generate buyer interest. In the USA, most market participants are deferring sales transactions in anticipation of an announcement this month of either a Supreme Court decision or an out-of-court settlement of the Producers' lawsuit.

The **US Premium** for **U_3O_8** increased to **$0.60** this month, placing the Exchange Value plus the US Premium for U_3O_8 at the $16.00 level. For the past few months, the price of US-origin material has tended to stabilize around this $16.00 mark, indicating a fairly static price for US-origin material rather than an actual increase in its value. The sole U_3O_8 transaction occurring this month was priced near that level.

With firm demand now at a minimum, most natural uranium buyers and sellers, and particularly US sellers, are hesitant to make discretionary purchases or sales because of the various pending judicial and political events. The most interesting development this month was a new initiative undertaken by the Reagan Administration, Congress, and US producers to reach an omnibus settlement of several uranium industry issues. DOE, in conjunction with the US Producers, is drafting legislation to be attached to the Free Trade Agreement (FTA) implementing legislation that includes sections of the Uranium Revitalization, Tailings Reclamation and Enrichment Act (Title II - the establishment of a mill tailings fund, and Title III - the establishment of a private enrichment corporation). In addition, the legislation would repeal Section 161(v) of the Atomic Energy Act requiring DOE to restrict enrichment of foreign uranium, and it would provide for DOE to purchase as much as $750 million worth of US uranium beginning in 1989. (See page 4 for a summary of the proposed funding and distribution.) The draft legislation is expected to go to several committees for review, including the Senate Energy Committee. If Congress agrees, by mid-June the Administration could incorporate the new provision in the FTA implementing legislation.

If the above settlement is not reached soon, the Supreme Court's decision on the US Producers vs. DOE lawsuit will be the next important signal to the uranium industry regarding future demand and price for US uranium. That decision is expected to be announced sometime in June before the Court recesses.

* * *

Active supply of natural uranium (concentrates and UF_6) for spot delivery totals **6,990,000 pounds** U_3O_8 equivalent, up 1,390,000 pounds from last month. The corresponding figure for **active demand** is **910,000 pounds**, down 300,000 pounds. The spot and near-term **supply-demand ratio** is **7.8**, a substantial increase over last month's ratio of 4.8.

* * *

The **Transaction Value** is **$16.10** per pound U_3O_8, down $0.35 since last month. The calculation extends over a five-month period and includes 21 transactions involving 2.6 million pounds equivalent U_3O_8. To meet the required parameters of the Transaction Value, the transaction period has been extended to five months. (Last month, the transaction period was also five months.) Because this month's Transaction Value includes sales from January (when the Exchange Value was $16.30), its response to the declining Exchange Value has been delayed.

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The **UF_6 Value is $44.75** per kilogram U as UF_6, down $0.50 since April. Two buyers made purchases at prices below last month's UF_6 value of $45.25, and an additional UF_6 sale was made at a slightly higher price. One of the transactions involved US-origin UF_6.

The **US Premium** for **UF_6** increased to $1.00 this month. As in the case for the U_3O_8 premium, this higher premium indicates that the price for US-origin UF_6 has somewhat stabilized, pending the possible resolution of the current legal controversy surrounding the US uranium industry, and is not weakening along with the non-US UF_6 price right now. Demand for UF_6 of any origin remains thin, and only one utility is known to be actively seeking UF_6 (or possibly U_3O_8) on the spot market.

Two enriched uranium product (EUP) sales were concluded this month, one of which involved a US utility; the other, a non-US utility. Both sales involved low feed prices and thus contributed to the downward pressure on the UF_6 Value this month.

Over the past few years, the market for EUP has grown significantly. Because of the inverse relationship between feed and SWU prices when combined as EUP, it is difficult to accurately report individual prices for UF_6 and SWU in EUP transactions. Either the feed or SWU price, however, can be determined if the EUP price, the enrichment and tails assays, and one of the component prices are known.

* * *

The **Loan Rate** is unchanged from last month at **3.5** percent per annum. Some activity has occurred recently in the loan market, but no transactions met the arms-length criterion for reporting this month.

* * *

The **Conversion Value** remained at **$1.80** per pound U as UF_6 for the fourth consecutive month. The two secondary conversion transactions of the month were concluded at or near the current Conversion Value. One calls for 1988 delivery; the other specifies delivery in early 1989.

* * *

ENRICHMENT SERVICES AND SWU

The **SWU Value** remained at **$68** during an unusually active month. One secondary market SWU sale is reported involving non-DOE SWU priced slightly below market. One significant sale of non-Soviet enriched uranium product (EUP) was believed to include a price for the SWU component at or near the current SWU Value. One other EUP sale involved DOE marketing a customer's excess SWU and was priced at a premium above market.

The SWU market continues to be characterized by a wide variation of prices, dependent primarily on origin, but also on timing and enrichment assays. Soviet-origin SWU are generally available at a discount off the SWU Value, whereas DOE-origin SWU command a premium.

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PRICING

PROPOSED AGREEMENT BETWEEN DOE AND THE US PRODUCERS

The agreement between DOE and the US Producers currently being drafted for consideration by Congress provides for the establishment of a $1.75 million fund of which $750 million would be used to purchase uranium from US producers, and $1 billion would be allocated for mill tailings reclamation.

Proposed Contributions to the Fund

Participant	Total Amount	Fees
Utilities with nuclear power plants	$1 billion	Constant fee (currently estimated as $72) per kg uranium loaded into reactors from 1988-1993. Payments may begin in 1989.
US producers	$300 million	$2 million per mill site $1 per dry ton of tailings
New enrichment corporation	$450 million	$90 million per year starting in 1989

Proposed Fund Distribution

Year	Amount
1st year	$160 million
2nd year	$150 million
3rd year	$140 million
4th year	$130 million
5th year	$120 million

Under the plan, DOE would purchase uranium mined and milled in the USA, possibly beginning as early as 1989. There is also discussion of special incentives for small producers (i.e., preferential treatment under the program).

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (May 31, 1988)	Last Month (Apr 30, 1988)	12 Months Ago (May 31, 1987)	This Month (May 31, 1988)	Last Month (Apr 30, 1988)	12 Months Ago (May 31, 1987)
Australia (dollar)	19.07	20.76	23.84	49.58	53.98	61.97
Belgium (comm. franc)	550.00	550.12	640.30	1,430	1,430	1,665
Canada (dollar)	19.07	19.37	22.84	49.59	50.36	59.37
EEC (ecu)	12.65	12.68	14.90	32.89	32.97	38.75
Finland (markka)	62.30	62.82	74.79	161.96	163.33	194.44
France (franc)	88.91	89.29	102.97	231.16	232.12	267.69
FRG (mark)	26.44	26.29	30.82	68.74	68.34	80.12
Italy (lira)	19,605	19,529	22,269	50,970	50,771	57,894
Japan (yen)	1,904	1,961	2,433	4,949	5,098	6,326
Netherlands (guilder)	29.58	29.48	34.76	76.90	76.64	90.36
South Africa (rand)	34.34	33.83	34.34	89.27	87.96	89.29
Spain (peseta)	1,742	1,737	2,151	4,529	4,516	5,591
Sweden (krona)	91.45	92.27	107.59	237.75	239.87	279.72
Switzerland (franc)	22.10	21.79	25.55	57.45	56.65	66.43
UK (pound)	8.29	8.40	10.43	21.56	21.84	27.11
US (dollar)	15.40	15.75	17.00	40.04	40.95	44.20

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (May 31, 1988)	Last Month (Apr 30, 1988)	12 Months Ago (May 31, 1987)	This Month (May 31, 1988)	Last Month (Apr 30, 1988)	12 Months Ago (May 31, 1987)
Australia (dollar)	19.94	21.69	24.12	51.83	56.38	67.70
Belgium (comm. franc)	575.00	574.57	647.83	1,495	1,494	1,684
Canada (dollar)	19.94	20.23	23.11	51.84	52.60	60.07
EEC (ecu)	13.23	13.25	15.08	34.39	34.44	39.20
Finland (markka)	65.13	65.62	75.67	169.32	170.59	196.73
France (franc)	92.96	93.25	104.18	241.66	242.44	270.84
FRG (mark)	27.64	27.45	31.18	71.87	71.37	81.07
Italy (lira)	20,497	20,397	22,531	53,286	53,027	58,575
Japan (yen)	1,990	2,048	2,462	5,174	5,324	6,401
Netherlands (guilder)	30.93	30.79	35.17	80.40	80.04	91.43
South Africa (rand)	35.90	35.34	34.75	93.33	91.87	90.34
Spain (peseta)	1,821	1,814	2,176	4,735	4,717	5,657
Sweden (krona)	95.61	96.37	108.86	248.55	250.53	283.01
Switzerland (franc)	23.10	22.76	25.85	60.06	59.17	67.21
UK (pound)	8.67	8.77	10.55	22.54	22.18	27.43
US (dollar)	16.10	16.45	17.20	41.86	42.77	44.72

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb U as UF_6			per kg U as UF_6		
Country (currency)	**This Month (May 31, 1988)**	**Last Month (Apr 30, 1988)**	**12 Months Ago (May 31, 1987)**	**This Month (May 31, 1988)**	**Last Month (Apr 30, 1988)**	**12 Months Ago (May 31, 1987)**
Australia (dollar)	2.23	2.37	2.52	4.91	5.23	5.56
Belgium (comm. franc)	64.29	62.87	67.80	141.73	138.61	149.47
Canada (dollar)	2.23	2.21	2.42	4.91	4.88	5.33
EEC (ecu)	1.48	1.45	1.58	3.26	3.20	3.48
Finland (markka)	7.28	7.18	7.92	16.05	15.83	17.46
France (franc)	10.39	10.20	10.90	22.91	22.50	24.04
FRG (mark)	3.09	3.00	3.26	6.81	6.62	7.19
Italy (lira)	2,292	2,232	2,358	5,052	4,920	5,198
Japan (yen)	222.50	224.10	257.66	490.52	494.06	568.04
Netherlands (guilder)	3.46	3.37	3.68	7.62	7.43	8.11
South Africa (rand)	4.01	3.87	3.64	8.85	8.52	8.02
Spain (peseta)	203.62	198.54	227.70	448.90	437.71	502.00
Sweden (krona)	10.69	10.54	11.39	23.56	23.25	25.12
Switzerland (franc)	2.58	2.49	2.71	5.69	5.49	5.96
UK (pound)	.97	.96	1.10	2.14	2.12	2.43
US (dollar)	1.80	1.80	1.80	3.97	3.97	3.97

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	SWU Value at 0.30% Tails Assay This Month (May 31, 1988)	**SWU Value at 0.30% Tails Assay Last Month (Apr 30, 1988)**	**UF_6 Value per kg U as UF_6 This Month (May 31, 1988)**	**UF_6 Value per kg U as UF_6 Last Month (Apr 30, 1988)**
Australia (dollar)	84.21	89.65	55.41	59.65
Belgium (comm. franc)	2,429	2,375	1,598	1,581
Canada (dollar)	84.22	83.64	55.42	55.65
EEC (ecu)	55.87	54.76	36.76	36.43
Finland (markka)	275.08	271.24	181.02	180.49
France (franc)	392.61	385.49	258.37	256.51
FRG (mark)	116.76	113.48	76.83	75.51
Italy (lira)	86,569	84,315	56,970	56,107
Japan (yen)	8,405	8,466	5,532	5,634
Netherlands (guilder)	130.62	127.27	85.95	84.69
South Africa (rand)	151.62	146.08	99.77	97.20
Spain (peseta)	7,692	7,501	5,062	4,991
Sweden (krona)	403.80	398.36	265.73	265.08
Switzerland (franc)	97.57	94.08	64.21	62.60
UK (pound)	36.62	36.27	24.10	24.13
US (dollar)	68.00	68.00	44.75	45.25

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4297	1988	301-600	98-102	Producer	Utility	UF_6
4300A	1988	601-1,000	R[3]	Intermediary	Utility	Contained in LEU
4303A	1988	101-300	R[3]	Intermediary	Intermediary	Contained in LEU
4306	1988	less than 50	98-102	Intermediary	Intermediary	US Origin UF_6
4314	1988	101-300	98-102	Intermediary	Utility	UF_6
4315	1988	101--300	98-102	Intermediary	Utility	US-Origin

Conversion Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks
4299	1988	101 - 300	98-102	Utility	R[3]	
4310	1989	101-300	103-107	Intermediary	Utility	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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CURRENT MARKET DATA

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4300B	1988	101-300	R[3]	Intermediary	Utility	R[3]	Cont. in LEU
4303B	1988	less than 50	R[3]	Intermediary	Utility	DOE	Cont. in LEU
4312	1989	50-100	R[3]	Intermediary	Utility	R[3]	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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URANIUM SUPPLY
(May 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
87-1002	270	—	
87-1023	500	500 per year	1988-90
87-1061	1,000	700 per year	1988-91
87-1123	1,000	1,000 per year	
87-1130A*	300	—	1988
87-1141	500	200 per year	1989-92
87-1161	1,000	1,000 per year	UF_6
88-1000A*	80	—	1988
88-1000B*	60	—	1988, UF_6
88-1001	200	200 per year	1988-91
88-1026	250	—	1988
88-1033A	130	—	1988, UF_{6e}
88-1036	100	—	1988
88-1064*	400	400 per year	1988-90
88-1078*	1,200	—	1988
87-1001	—	500 per year	1989 on
87-1005	—	250 per year	1988-95
Total	**6,990**		
INACTIVE			
87-1019	1,000	1,000 per year	1988-91
87-1053	100	400 per year	1989 on
87-1159	60	—	
88-1041*	680	—	UF_6
88-1086*	75	—	1988
87-1130B*	—	480	1989
Total:	**1,915**		

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*New or revised since last month

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1135, 87-1136, 87-1152.

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URANIUM DEMAND
(May 31, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Inquiries to Purchase: ACTIVE			
88-1035A	40	—	1988, UF_6e
88-1060	300	—	1988, U_3O_8/UF_6
87-1069	50	—	1988
88-1075A*	20	—	1988, UF_6e
88-1084*	500	—	1988
87-1013	—	1,200 per year	1990-95
87-1021	—	200 per year	1992 99
87-1134	—	260	1989
87-1172	—	500 per year	1990 on
88-1044	—	2,400	1991-95
88-1056	—	500 per year	1989-93, U_3O_8 or UF_6
88-1062	—	200 per year	1990-on
88-1080*	—	150	1991
Total:	**910**		
IN[illegible]TIVE			
87-1154A	80	—	1988, UF_6e
88-1014	190	—	1988
88-1083*	800	—	1988
87-1163	—	160	1989-93
87-1166	—	650	1989, UF_6
Total:	**1,070**		

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*New or revised since last month.
[1] Measured from the date of this Report.
[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 88-1045, 88-1072.

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LOAN SUPPLY AND DEMAND
(May 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8)		Remarks
	Within 1 Year	Beyond 1 Year	
Available for Loan:			
ACTIVE			
87-1012*	1,000	—	
87-1071	1,000	—	UF_6
87-1157	4,000	—	
88-1057*	600	—	
Total:	**6,600**		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
Total:	**2,000**		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month:

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(May 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF₆) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
INACTIVE			
87-1008*	770	475	1988
Total:	**770**		
Inquiries to Purchase			
ACTIVE			
88-1034*	750	—	1990
Total:	**750**		
INACTIVE			
88-1021	65	—	
Total:	**65**		

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*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 88-1059.

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SWU SUPPLY AND DEMAND
(May 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
87-1058*	50	—	1988
87-1068	200	—	1988,UF6e
88-1033B	15	—	1988,UF6e
Total	**265**		
INACTIVE			
87-1004	55	—	1988
87-1128	360	—	1988
88-1082*	25	—	1988
Total:	**440**		
Inquiries to Purchase ACTIVE			
88-1035B	20	—	1988, UF6e
88-1074	80	—	1988
88-1075B*	11	—	1988, UF6e
88-1077*	—	70	1989-91
Total:	**111**		
INACTIVE			
87-1154B	20	—	1988, UF6e
Total:	**20**		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 88-1058.

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AUSTRALIA

Australian Labor Party Unlikely to Debate Three-Mine Policy at Upcoming Conference

As the Australian Labor Party (ALP) prepares for its biennial conference, uranium has again appeared as a national issue, gaining extensive media attention and creating considerable tension within the ALP. One observer of the Australian uranium scene noted that "the resurgence of the 'Great Uranium Debate' has been spurred by the mining lobby and the wide distribution of two uranium market reports: a Nuexco study commissioned by Pancontinental Mining and a report prepared by the University of Melbourne's Institute of Applied Economic and Social Research"- both of which indicate that there is a substantial market for Australian uranium in the 1990s. The latest champions of additional uranium development are the traditional (Aboriginal) owners of the Koongarra leases who have been pressing for early exploitation of the Denison project, in which they have a 25 percent equity interest.

Efforts by sections of the Center-Left and Right factions of the ALP to have the three-mine policy debated at the conference appear to have failed due to lack of support and fears that a re-opening of the debate could lead to greatly increased friction within the Party. The ALP already must contend with a number of other difficult and potentially divisive political issues including privatization, wages policy, and tertiary education. Prime Minister Bob Hawke, a pragmatist who is at least intellectually pro-nuclear, has generally managed to stay out of the debate, allowing it to focus on the responsible Minister, John Kerin, who has continued to support the current three-mine policy.

While the mining lobby's campaign and the two reports mentioned above have created new support within ALP ranks for a more liberal uranium development policy, the hard core opposition of the ALP's Left has not been swayed. Unless and until the present restrictive policies are changed, approvals for new uranium mine development may have to wait for at least two more years. These restrictions will prevent Australia, with over 30 percent of the Western World's low-cost uranium resources, from achieving its proportionate share of the large, uncommitted uranium market now forecast for the 1990s.

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FEDERAL REPUBLIC OF GERMANY

New Government in Schleswig-Holstein Pledges to Shut Down Three Nuclear Plants

After 38 consecutive years in power, the conservative Christian Democratic Union (CDU) and centrist Free Democrats (FDP), lost their combined majority in the state government of Schleswig-Holstein to the Social Democratic Party (SPD) on May 8, 1988. The SPD, which won 54.5 percent of the vote, campaigned on a platform that includes the complete phase-out of nuclear power in the state. Currently, three nuclear plants are operating in Schleswig-Holstein: Brunsbüttel (771-MW BWR), Krümmel (1260-MW BWR), and Brokdorf (1307-MW PWR). All three are jointly owned by PreußenElektra AG (PREAG) and Hamburgische Electricitätswerke AG (HEW). Together the three plants provide about 75 percent of the state's electricity, the highest percentage in any state of the Federal Republic of Germany. Cost estimates for near-term shutdown approach DM 117 billion (approximately US $68 billion), which include lost investment and energy replacement by new coal plants.

The new socialist energy minister Mr. Guenther Jansen has announced plans to appoint experts to review the safety of plant operations, to study long-term waste storage, and to evaluate alternative energy sources. In early June the SPD is expected to announce the specific procedure for implementing its energy policy. The plants' owners have pledged to take any shutdown order to the federal supreme court in Bonn. The CDU, in coalition with the FDP and the Christian Social Union (CSU), currently has a majority in the federal parliament.

While the SPD's anti-nuclear rhetoric has been pronounced, the policy to be implemented could be less drastic now that the party must govern and choose a course for the state's economy.

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FRANCE

Release of French Hostages in Iran May be Tied to Partial Eurodif Loan Repayment

The French newspaper *Le Monde* (May 7, 1988) reported that the recent liberation of three French citizens held

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hostage by Islamic terrorists may have been connected to a settlement of the complex dispute between France and Iran over nuclear energy projects. The main projects in dispute are Iran's investment in Eurodif, via the French CEA (Commissariat a l'Energie Atomique), whose resposibilities in this matter are suceeded by Cogema, and Iran's order for two PWR reactors from Framatome, the French reactor vendor. Iran reneged on its commitments to the two projects following the accession to power of the Ayatollah Khomeini's government in 1979.

In 1974, the Iranian government of Shah Reza Pahlavi extended an eight-year loan of one billion US dollars to the CEA to help finance construction of the Eurodif enrichment plant at Tricastin, France. In return, Iran became a net ten-percent shareholder in Eurodif through a joint venture with CEA known as Sofidif (Table 1), with the obligation to take and pay for a corresponding share of Eurodif's SWU production beginning in the early 1980s. Following the overthrow of the Shah in 1979, the new government renounced nuclear energy and the Shah's commitments to the French nuclear industry. The French called for arbitration to recover damages, claiming nine billion French francs for the default on Eurodif and five billion French francs owed to Framatome for default on the power plant order. Pending resolution of the dispute, the CEA rescheduled payment of principal on the Eurodif loan until 1992, a ten-year delay, and began paying interest to a blocked account.

While no formal judgment has been announced in the case nor any resolution of the dispute agreed upon publicly, the French government of the conservative Prime Minister Jacques Chirac apparently did pay Iran one-third of the principal on the Eurodif loan (US $330 million) in 1986 as a gesture of accommodation. In November 1987 when two French hostages held in Beirut were released, speculation arose in the western press regarding a second payment of one-third of the principal by France; the French government never confirmed the alleged payment. The release in May 1988 of the last three French hostages held in Beirut, also orchestrated by the Chirac government, has led to the inevitable presumption of a third and final payment of the principal. According to *Le Monde*, if the payments actually took place, they must have come from the French Treasury since funds from the blocked Eurodif loan account were legally inaccessible.

Table 1
OWNERSHIP OF EURODIF S.A.

Company	Country	Percent Share
Cogema[1]	France	36.528
Sofidif[2]	France/Iran	25.000
Synatom[3]	Belgium	11.111
Enusa[4]	Spain	11.111
ENEA[5]	Italy	8.125
Agip SpA	Italy	8.125
Total		100.000

[1] Cogema = Compagnie Générale des Matières Nucléaires (owned 100 percent by the French CEA)

[2] Sofidif = Société Franco-Iranienne pour l'Enrichissement de l'Uranium par Diffusion Gazeuse (owned 60 percent by Cogema and 40 percent by the Atomic Energy Agency of Iran)

[3] Synatom = Société Belge des Combustibles Nucléaires Synatome S.A.

[4] ENUSA = Empresa Naçional del Uranio SA

[5] ENEA = Comitato Nazionale per la Ricerca e per lo Sviluppo dell'Energia Nucleare e delle Energie Alternative

* * *

JAPAN

Prototype Enrichment Plant Begins Operation

On April 25, Japan's Power Reactor and Nuclear Fuel Development Corporation (PNC) began operation of its prototype centrifuge enrichment plant at Ningyo Toge, Okayama. Known as DOP-1, this unit has a 100,000 SWU-per-year capacity. An additional unit for the prototype plant is planned for start-up in 1989.

Construction of the prototype plant began in November 1985. Costs for completion of the 15,000 square meter enrichment facility reached approximately 56 billion yen (US $448 million), eleven billion yen less than its original

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estimates due in part to improved performance of centrifuge and peripheral equipment. The utility industry and government financed approximately 50 percent of the cost, while loans provided the remaining funding. The technology developed from this prototype plant will be used on a commercial scale upon completion of the plant at Rokkasho Muro, Amori Prefecture, scheduled to begin operation in 1991. Phase One of the commercial program calls for construction of a 600,000 SWU-per-year enrichment plant, with an additional 900,000 SWU capacity to be added in 100,000 SWU increments over ten years in Phase Two. Capacity of the plant will ultimately reach 1.5 million SWU per year, and it will supply more than twenty percent of Japan's enrichment requirements. This facility will be owned and operated by Japan Nuclear Fuel Industries (JNFI), which was organized in 1985 by a consortium of all the Japanese electric utilities and other nuclear energy companies.

Completely dependent on enriched uranium imports (approximately 90 percent from the USA; ten percent from France), Japan has invested over 130 billion yen (US $1.04 billion) in centrifuge separation research and development. PNC chose the centrifuge separation method because of its lower energy consumption compared to the gas diffusion method. In addition, the centrifuge technology is more easily adaptable to small-scale operations because centrifuge separators can be added modularly. PNC first used centrifugal separation in a pilot plant which began operating in 1979 as part of a ten-year program. The domestically-enriched uranium will be used for Japanese light water reactors, although probably no sooner than 1989. Ten utilities, including Japan Atomic Power Co. (JAPC), will purchase a small amount of their enrichment requirements from DOP-1. The unit only has the production capacity to provide a 1,000 MWe reactor with fuel for approximately ten months.

PNC's timing for the enrichment facility's commercial start-up, however, does not coincide with the most favorable economic conditions, as the rapidly rising yen has caused the domestic enrichment program's costs to soar above those of the established foreign enrichers. Whereas PNC's enrichment cost at DOP-1 is slightly above 20,000 yen (US $159) per SWU, DOE is offering enrichment services under its most prevalent contract at 14,600 yen (US $117) per SWU. PNC has not yet established its SWU offering price to Japanese utilities. At present, it does not appear likely that PNC will offer enrichment services to non-Japanese customers.

To help reduce the large cost differential between domestic and foreign enrichment sources, PNC and JNFI are developing a new type of centrifugal separator with greater rotation capabilities, which is expected to improve cost efficiency by more than twenty percent. The separator will be introduced in the second phase of JNFI's commercial plant program.

Other Enrichment Research and Development

Japan is also aggressively pursuing research and development in other enrichment methods, although only the centrifuge process is commercially available at this time. In 1987, nine commercial utilities, three Japanese industrial companies (Mitsubishi, Hitachi and Toshiba), the Japan Atomic Power Co., and the Central Research Institute of the Electric Power Industry formed the LASER-J association to research and develop atomic laser isotope separation (AVLIS) enrichment technology. The government and utilities provide approximately half of the $65 million annual funding (over four years), while the three major industrial members fund the other 50 percent. In addition, the Science and Technology Administration allocated $740 million yen (US $592 million) to the Japan Atomic Energy Research Institute (JAERI) for basic AVLIS research. JAERI passes on some of its findings to Mitsubishi, Hitachi and Toshiba who each have specific areas of research under the LASER-J association. Other enrichment technologies currently under study in Japan include chemical separation, molecular laser isotope separation (MLIS), and ion exchange.

The chemical separation process, although second in technical maturity, still needs a few years to confirm its reliability. The AVLIS and MLIS technologies are at least ten years away from being commercially feasible. In the meantime, Japan's domestic enrichment program will continue to face uncertainties regarding its competitiveness in the international enrichment market, and may have to rely on utilities or on government subsidies to provide some financial relief in order to develop a fully indigenous nuclear fuel cycle.

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UNITED STATES

Agreement Reached to Close Shoreham

Long Island Lighting Company (LILCO) and the State of New York reached agreement in principle on May 26, 1988 to settle a long-standing dispute over the fate of the Shoreham nuclear power plant. The State will buy the $5.3 billion nuclear plant for $1, decommission and dismantle it, and allow LILCO to raise its electricity rates by five percent annually for at least three years and possibly as many as ten years. The State will also allow LILCO to earn a thirteen percent return on equity, including most of its investment in Shoreham. Shoreham will be the second substantially completed US nuclear plant to be permanently shut down before entering full commercial operation. Cincinnati Gas & Electric Company's 97 percent-completed Zimmer plant was the first premature closure, shut down in 1983.

Shoreham received approval in 1970 for construction and first filed for licensing approval in 1975. Licensing hearings began in 1982 and have resulted in legal costs surpassing $25 million. State and local officials have argued that Shoreham should be closed since it would be impossible to evacuate Long Island residents in the event of an accident, and New York Governor Mario Cuomo has refused to allow State officials to participate in Nuclear Regulatory Commission (NRC)-mandated plant-evacuation drills. In October 1987, the NRC changed its ruling that required state officials to participate in plant evacuation drills. The new ruling allowed the substitution of plant personnel for state personnel during drills, and was based on the "realism" argument, i.e., that during actual emergencies state and local officials would act to protect the public. LILCO conducted a full drill in February 1988 using its personnel, but the NRC found the plan faulty and denied the Shoreham plant a full operating license.

Governor Cuomo also attempted to thwart Shoreham's start-up by creating the state agency Long Island Power Authority (LIPA) in 1986. The New York legislature authorized LIPA to take over LILCO if the takeover would result in lower electricity rates. The investment banking firm of Lazard Freres released a study showing a twelve percent rate savings to investors over fifteen years if LIPA took over the utility, while LILCO's in-house and independent consultant studies projected a conflicting outcome, with government ownership causing rate increases of six to ten percent. On March 29, 1988, LIPA made an offer of $745 million (less than current book value) to buy out LILCO, but LILCO did not respond to this offer by the April 15, 1988 deadline.

The May 26th agreement, which only provides for the purchase of Shoreham rather than the previously-proposed public ownership of LILCO, will be a less expensive way to shut down Shoreham, according to Governor Cuomo. LILCO's customers, now paying the third highest electric rates in the USA, will nevertheless bear the brunt of Shoreham's shutdown and replacement cost. Moreover, according to US Secretary of Energy John Herrington, Long Island residents may experience brownouts through the next few years as demand during peak times exceeds load capacity. Nevertheless, the agreement is expected to be ratified by LILCO shareholders, the New York Public Service Commission (PSC), the New York legislature, and the NRC. Cuomo has requested the PSC and the state legislature to approve the deal within 90 days.

It is too early to tell how Shoreham's closure will affect the neighboring Seabrook nuclear plant in New Hampshire, another completed but unlicensed plant whose public officials have opposed its emergency evacuation plan. While Seabrook's opponents may attempt to find a precedent in Shoreham, the enormous expense of scrapping Shoreham may dissuade the New England public from favoring the closure of another nuclear plant. The potential shut-down costs of Seabrook are also estimated to be much higher than Shoreham, because electricity rates would have to be significantly raised to cover the owners' investment in the plant, none of which has yet been recouped. The financial situation of Seabrook's principal owner, Public Service Company of New Hampshire (PSNH), further complicates the matter; PSNH filed for bankruptcy under Chapter 11 in January because it was unable to make interest payments on Seabrook-related debt. Another partial owner (11.6 percent), Massachusetts Municipal Wholesale Electric Co., announced it was putting its interest up for sale, and has stopped paying its share of the plant's maintenance expense (approximately $1.2 million per month). The start-up of Seabrook, however, does have the support of New Hampshire Governor John Sununu, which may have a significant effect on its future.

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ANALYSIS AND COMMENTARY

TRENDS IN NATURAL URANIUM CONTRACTING

The following article is based on selected portions of Nuexco's comprehensive study entitled "Contracting for Uranium: An Analysis of Trends in Terms and Conditions". The study documents and analyzes historical trends and current practices in natural uranium contracting (concentrates and UF6), reviews and analyzes purchasing strategies of the various countries, and provides recommendations on terms and conditions for new contracts and for the possible renegotiation of existing contracts.

* * *

Natural uranium contracting practices have undergone a significant transformation since the late 1970s, largely due to the shift from a seller's market to a buyer's market. The turnabout resulted primarily from the inadvertent buildup of high inventory levels in the late 1970s due to widespread reactor cancellations, the substantial decline in projections of uranium demand, and the resultant excess supply capability of uranium producers. The precipitous price decline, from $43.40 per pound U_3O_8 in mid-1978 to $17.00 in August 1982, with interim fluctuations, created a very different environment for purchasers, who now have strongly competing supply sources from which to choose and who can consequently benefit from more favorable contract provisions being offered.

Although there are many common trends in natural uranium contracting, there remains a great disparity among regional preferences for certain terms, particularly regarding flexibility in pricing and delivery terms. This article presents some of Nuexco's findings on the evolution of long-term uranium procurement and supply, based on uranium transaction records for the period 1980-1987. The study focuses on arms-length natural uranium transactions (concentrates or UF_6) involving term contracts.

Pricing and Price Mechanisms

One of the most variable and evolving contract provisions concerns price structure. The three most prevalent types are:

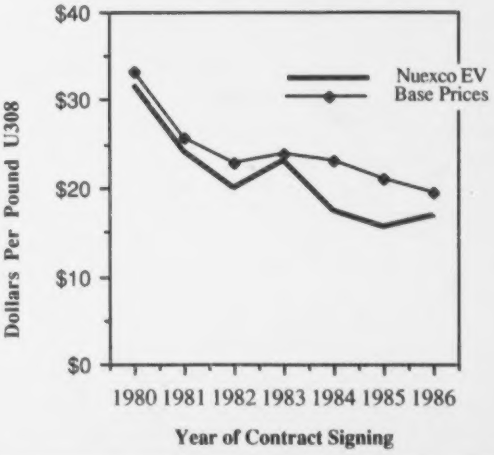
1. Defined Price
2. Market-Related Price
3. Negotiated Price

Defined Pricing

A "defined price" is one that both parties agree upon at contract execution. It may be a fixed price, in which case the price would incorporate the seller's implicit estimate of the future effects of inflation and market activity, or it may be a base price which is to be adjusted for inflation using a specified formula and indexes. Non-US buyers tend to use defined pricing in term contracts almost twice as often as do US buyers.

The concept of a base price subject to escalation arose in the early years of the nuclear industry as a means of compensating for the effects of inflation. Although the intent of the escalation clause generally is to protect the seller when production costs are rapidly rising, the escalation factor would benefit the buyer if the general monetary inflation rate exceeded the escalation rate, or would benefit the seller if the escalation rate exceeded the inflation rate. A common escalation method in the USA is based on the Gross National Product Implicit Price Deflator (GNP IPD). Other types of escalation factors are tied to specific industry wage standards, and sometimes a combination of several different indexes is used.

Figure 1
BASE PRICES IN LONG-TERM CONTRACTS AND SPOT PRICES



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An interesting observation from the NUEXCO database is that base prices in new long-term contracts have tended to trend with the spot price prevailing at the time of contract signing. As shown in Figure 1, base prices have fallen along with spot prices since 1980.

Market-Related Pricing

The "market-related" pricing mechanisms vary, but generally take one or more of the following forms:

- market price
- market price less fixed discount
- market price less discount that depends on market price
- market price with floor
- market price with ceiling
- market price with floor and ceiling

Sometimes one of these mechanisms is combined with a provision that allows one or the other party to terminate all or a portion of the contract if the contract price exceeds pre-defined limits. This concept, known as the "walkaway" provision, effectively permits renegotiation of the contract at certain pricing trigger points.

1. The straight "market price" is based on some predetermined market price indicator, frequently the Nuexco Exchange Value or combinations of it and other indicators, and generally prevails in short or medium-term transactions.

2. The "market price less discount" was the second most popular pricing mechanism in the sampling, and has been used more frequently in recent years. In a typical example of this mechanism, the contract provides for a one to five percent discount from the current market price in the delivery month, with market price defined as the most recently published Nuexco Exchange Value or some other indicator.

3. An example of the "market price less discount depending on market price would be a discount of one percent per five dollar increment by which the market price exceeds an established base price plus adjustment. So, if the Nuexco Exchange Value were $21.00 and the base price plus adjustment were $16.00, the discount would be $.21 and the resulting amount payable would total $20.79. Another example is the concept of increasing discounts from market price as market price exceeds certain thresholds.

4. The "market price with floor" often makes use of a defined price such as the base-plus-adjustment methodology for the floor. Under this mechanism, the price might be the higher of the current market price (such as the Nuexco Exchange Value) or a base price escalated to the month of delivery. This concept is generally called market price with floor because, if the market price drops to a certain level, the adjusted base price acts as the minimum price allowable under the contract. This pricing mechanism protects the seller from having to sell at below its cost when the market is weak. Because sellers were favorably positioned in the 1970s, the use of floor price provisions was almost universal. By 1987, however, as the market shifted from seller to buyer dominance, floor prices became less prevalent .

Figure 2 illustrates the floor price data for US contracts, based on information compiled by the US Energy Information Administration in its annual uranium surveys. The upper-most area of the graph shows the "market price with cost floor" concept, a relatively infrequent provision, where the floor price is based directly on the seller's production cost. These data are taken from contracts that were in existence as of December 31, 1986, although the relative proportions are expected to change as the presently unfilled requirements are placed under contract.

Figure 2
FLOOR PRICE BASIS
US MARKET-PRICED CONTRACTS
(for contracts in place at 12/31/86)

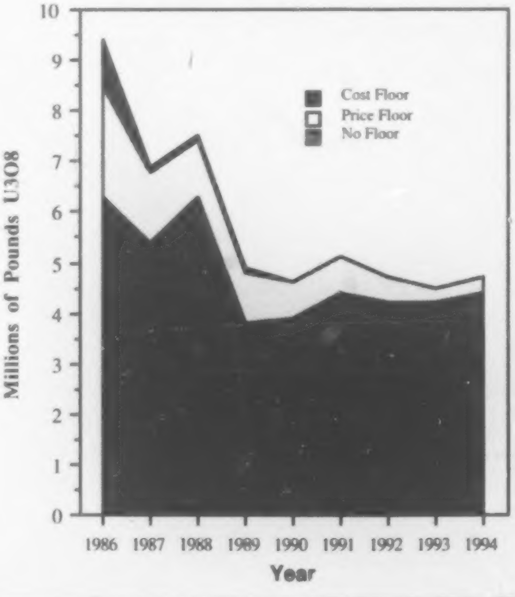

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Table 2
COMPARISON OF PRICING METHODOLOGIES UTILIZED IN TRANSACTIONS INVOLVING UTILITIES IN THE NUEXCO DATABASE
1980 Through 1987

Methodology	US %	Europe %	Far East %	Canada %	Worldwide %
Defined Price	19	49	-	20	27
Market Related Price	70	28	18	40	50
Negotiated	3	13	45	20	11
Other	2	5	-	-	2.5
Defined + Market Price Combination	-	3	-	-	0.8
Defined + Negotiated Combination	-	3	9	-	2
Market Price + Negotiated Comination	-	-	-	20	0.8
Market Price + Other Combination	6	-	27	-	5.9
Total					100

In the last seven or eight years, the "market price with ceiling" concept has gained some prominence as buyers seek to protect themselves in the event of unexpected increases in the market price. Here, the price is the lower of market or the defined ceiling price. In contrast to the floor price, a ceiling price takes effect if the market price rises above a predetermined value, thus setting the upper price limit under the contract. A ceiling price effectively reduces the buyer's risk if the market price rises sharply. Some contracts may provide for a "market price with both floor and ceiling", although this is not currently a prevailing practice.

Negotiated Price

The "negotiated price" is a price agreed to periodically (usually annually) by buyer and seller and may provide for third party arbitration if the parties are unable to agree.

As shown in Table 2, negotiated prices are most prevalent among Far Eastern utilities. For these utilities, 45 percent of the new contracts utilized negociated pricing and 27 percent used a "market price plus other" combination. European utilities utilized defined pricing in 49 percent of their new contracts, and used market price related mechanisms in 28. For Canada, 40 percent of the transactions were market price related. In the USA, 70 percent of the contracts were tied to the market, and 19 percent used a defined price.

Quantity Requirements and Flexibilities

The total nominal quantity of uranium to be delivered under a contract, excluding options or changes in amounts permissible under the flexibility provision (discussed later), is referred to as the contract quantity. Quantities are typically specified for "delivery years", which may not necessarily coincide with calendar years. The contract may specify a maximum or minimum contract quantity, separate and distinct from the flexibility provision.

The quantity of material under contract by utilities for delivery over a longer-term (more than one year) period

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has tended to decrease in previous years for European and US utilities, although the quantity has remained about the same in the Far East. For the eight-year period shown in Figure 3, utility contracts averaged 3.1 million pounds U_3O_8 in Europe, 3.3 million pounds in the Far East, 1.5 million pounds in the USA, and 3.6 million pounds in Canada. This is the result of abundant supply sources, a desire for many buyers to rely more on the lower-priced spot market, and an interest in minimizing risk by diversifying supply sources. Typically, European and Far Eastern purchasers have contracted from a wider supplier base than US purchasers, the majority of which have only US and Canadian suppliers. In addition, the non-US countries usually buy in lots roughly twice the size of those bought by US utilities, and they tend to cover a larger portion of their future requirements further into the future than do their US counterparts. This is further demonstrated by US utilities' large percentage of unfilled requirements in the 1990s.

Since the resurrection of the requirements-based US DOE enrichment contract, contract flexibilities in quantities and delivery schedules have become as important to utility buyers as price. The buyer now typically has the right to increase or decrease quantities to be delivered in a future delivery period by ten to twenty percent or more.

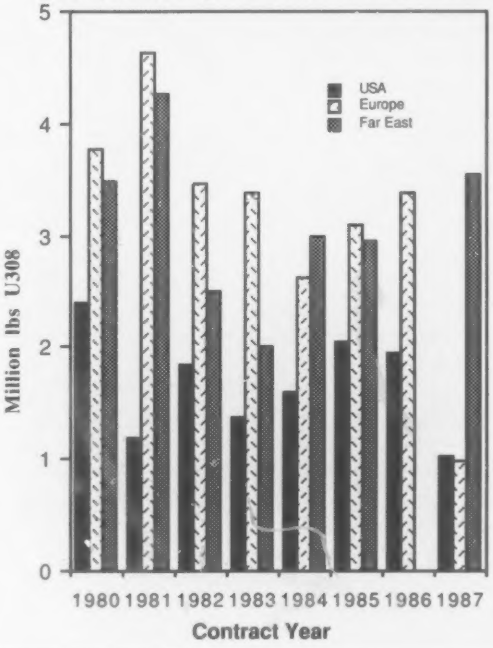
Delivery and Timing Flexibilities

Customarily, the buyer must notify the seller of its estimated uranium requirements six to eighteen months prior to delivery. If the contract includes a quantity flexibility provision, the buyer may request a greater or smaller quantity than is specified in the contract, and/or advance or defer the delivery date.

In the past, delays in a buyer's reactor construction program did not often entitle it to postpone deliveries. In recent years, however, a number of contracts have allowed such delays and other events affecting the buyer's uranium needs to adjust the delivery schedule. In addition, some contracts are on a facility-requirements basis, so the buyer eliminates all risk of having to take deliveries of material earlier than needed.

The duration of delivery period (contract term) is the time interval between the first and last delivery scheduled under contract, excluding any options or changes due to application of flexibility provisions. The contract term has shortened in recent years, particularly among US buyers. Long-term contracts calling for deliveries over ten years or more were common in the 1970s, as stability of supply was often perceived to be more important than price. Although security of long-term supply is still a valid concern, particularly in the Far East (which is almost totally dependent on imported energy sources), contract terms today are generally shorter. The average contract term for European and Far Eastern utilities' transactions was nine years, compared to the average delivery period of six years for US utilities and approximately seven years for Canadian utilities.

Figure 3
AVERAGE SIZE OF CONTRACT BY YEAR
USA, EUROPE, AND FAR EAST UTILITIES



Origin of Material

Due to recent litigation over DOE's alleged obligation to restrict enrichment of foreign uranium for US consumption, as well as the introduction of various legislation such as the Uranium Revitalization Bill calling for foreign-uranium usage restrictions, many US buyers have requested US-origin material to insure against possible restrictions on non-US uranium in the future.

ANALYSIS AND COMMENTARY

Additionally, because of the different safeguard and retransfer provisions established by each country, some buyers prefer certain origins over others. Uranium bearing the "N" or "P" safeguard code are preferable to some European utilities because there are no constraints on the reprocessing of the material, and because the removal of enrichment tails is not required when N or P code material is enriched in the USSR.

Political and social concerns in various parts of the world also affect buying decisions. In the USA and many parts of Europe, for example, Namibian and South African uranium is considered unattractive for political reasons; the US government has prohibited the import of South African U_3O_8, so it is no longer a purchasing concern for US utilities. Similarly, Canadian utilities are likely to continue purchasing strictly domestic uranium despite the absence of laws mandating it.

Termination

Termination rights are normally tied to the occurrence of a stated contingency condition. A party can seldom terminate a contract unilaterally, even with payment of a penalty charge. However, some provisions found in recent contracts allow for full or partial termination in the event of:

1. an extended reactor outage or substantial delay in a reactor's startup
2. a delay or reduction in reactor demand
3. a significant differential between the market price and contract price
4. the convertor refuses or is unable to process the material to be delivered by the seller
5. the required regulatory approvals can not be obtained
6. a lender defaults and the seller has no material to deliver
7. either party files for bankruptcy
8. import restrictions are imposed
9. there is an unexcused late delivery

Future Trends

The increasing popularity of market-related pricing and more liberal flexibility provisions in quantity and delivery schedules reflects the strong buyer's market of the mid-1980s. As a result of the increased competition for sales opportunities, contract size and contract duration are both decreasing, as more buyers seek to take advantage of changing market conditions and low spot-market prices. In particular, US utilities have largely avoided contracting for the significant unfilled requirements in the 1990s due to uncertainties regarding origin requirements that might be imposed by the US Government. As these questions are resolved, US utilities are expected to begin longer-term contracting at a greater pace.

Far Eastern utilities are expected to maintain the use of negotiated pricing provisions as a result of current business practices, while European utilities will continue to employ a variety of pricing provisions. To some degree, European buyers are placing more emphasis on market-related pricing, but that is mainly due to the price discrepancy between the spot market and defined prices under older contracts. In general, European and Far Eastern utilities are more concerned about long-term supply assurances and relationships than are their US counterparts. US purchasing trends should continue to focus on market-related provisions, a circumstance that can best be attributed to pressure and influence from public utility commissions. As worldwide demand begins to outstrip supply and inventory levels, the shift in the direction of a seller's market will lead to further changes in purchasing trends.

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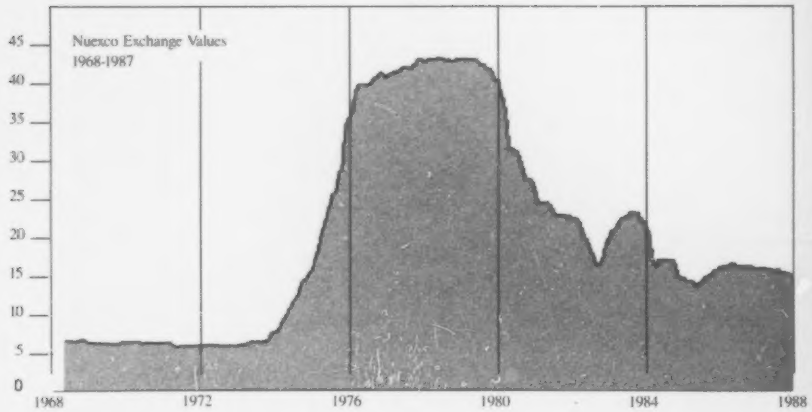
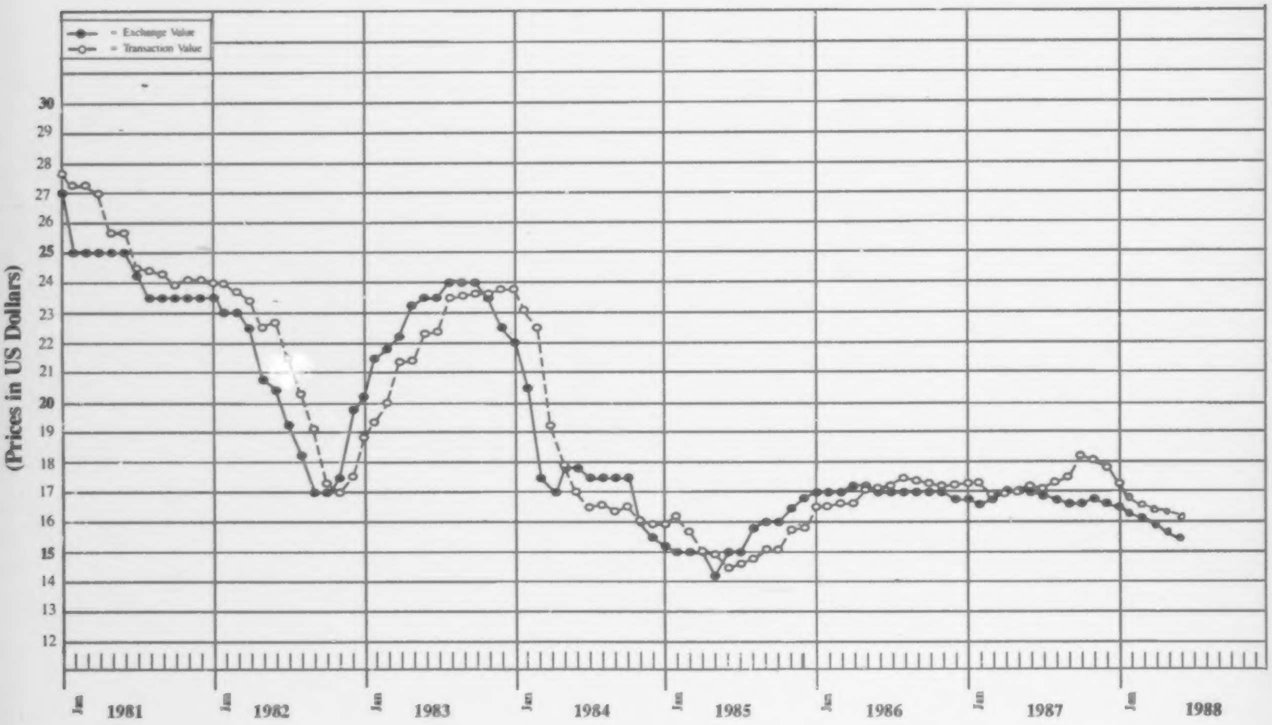
HISTORICAL MARKET DATA





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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	**15.40**							

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	.25	**.60**							

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	**16.10**							

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	**1.80**							

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	**44.75**							

HISTORICAL US UF_6 PREMIUM (Relative to the UF_6 Value)

Determined as of the last day of the month indicated ($US/kg U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	**1.00**							

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay)

Determined as of the last day of the month indicated ($US per SWU)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	**68**							

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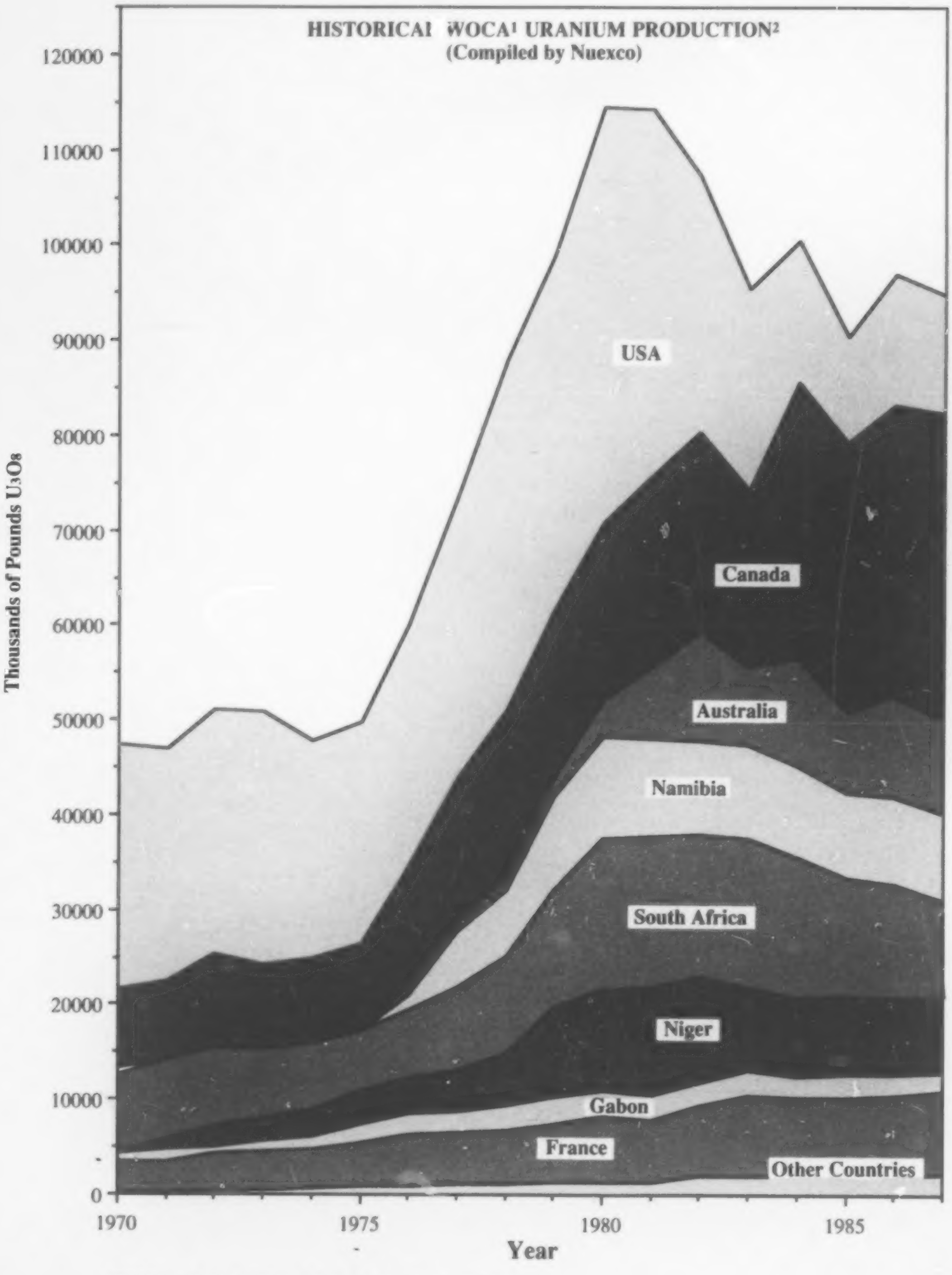
HISTORICAL MARKET DATA



[1] WOCA = World Outside of Centrally-Planned Economic Areas.
[2] 1987 production data are preliminary.

US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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HISTORICAL MARKET DATA

VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

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[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	202.7
1986	Avg.	155.5	101.5	213.0
1987	Avg.	—	108.9	—
Jan	1987	—	106.2	215.9
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2
Apr	1987	—	108.3	222.2
May	1987	—	108.1	222.0
June	1987	167.2	108.1	222.2
July	1987	—	108.7	222.5
Aug	1987	—	110.5	222.2
Sep	1987	170.0	109.3	222.8
Oct	1987	—	108.6	223.0
Nov	1987	—	110.0	222.6
Dec	1987	172.9	111.9	—
Jan	1988	—	112.4	—
Feb	1988	—	112.3	—

P = Preliminary R = Revised since last month

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[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

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GOVERNMENT STATISTICS

CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.1	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.5	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1	140.4	20.47	17.50	16.50	12.63	13.53
Dec	1987	125.5	140.5	20.62	17.31	16.37	12.54	13.75
Jan	1988	126.3R	140.8	20.70	17.54	16.65	12.82	13.73
Feb	1988	125.7	141.3	20.94	17.97R	17.07R	13.01R	13.69R
Mar	1988	126.0R	142.0	20.64P	18.10P	17.00P	13.11P	13.67P
Apr	1988	126.3	142.5	—	—	—	—	—

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-0ll). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975	Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976	Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977	Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978	Avg.	27.14	—	40.3	74.3	658,261	1,502,975
1979	Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	—	—	137.7	246.8	—	—
Jan	1987	—	—	128.9	233.9	750,496	529,682
Feb	1987	—	—	130.3	237.0	758,230R	600,258
Mar	1987	88.17	197.1	132.4	239.6	763,003R	536,033
Apr	1987	—	—	134.1	242.5	765,309R	535,876
May	1987	—	—	135.6	243.6	761,026R	531,732
Jun	1987	90.74	203.5	136.6	244.9	763,319R	571,407
July	1987	—	—	138.2	246.8	764,810R	624,954
Aug	1987	—	—	140.2	249.9	751,338	564,387
Sep	1987	100.79	224.7	142.0	252.4	742,417	587,707
Oct	1987	—	—	143.6	255.5	725,599	599,116
Nov	1987	—	—	144.8	256.3R	734,630	616,725
Dec	1987	100.34	267.0	145.9	258.3	712,896	613,262
Jan	1988	—	—	147.2	261.5	—	—
Feb	1988	—	—	148.2	265.7	—	—
Mar	1988	102.96	232.4	150.2	268.4	—	—
Apr	1988	—	—	151.9	—	—	—

P = Preliminary R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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GOVERNMENT STATISTICS

UNITED STATES

		Producer Price Index[1]				Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	**All Commodities (1982 = 100)**	**Consumer Price Index[2] (1982-1984 = 100)**	**GNP Implicit Price Deflator[3] (1982 = 100)**	**Metal Mining (SIC 10)**	**Primary Non-ferrous Metals (SIC 333)**	**Chemicals and Allied Products (SIC 28)**	**Electric and Electronic Equipment (SIC 36)**
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	111.2	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	114.1	13.20	13.49	11.98	9.65
1987	Avg.	102.6	102.8	113.6	—	—	—	—	—
Jan	1987	100.4	100.5	111.2	—	12.94	12.98	12.18	9.84
Feb	1987	100.8	101.0	111.6	—	12.99	12.83	12.21	9.84
Mar	1987	101.1	101.2	112.1	116.1	13.04	12.79	12.24	9.84
Apr	1987	101.6	101.9	112.7	—	13.16	12.90	12.30	9.82
May	1987	101.9	102.6	113.1	—	12.97	12.92	12.31	9.83
Jun	1987	102.4	103.0	113.5	117.2	13.05	12.93	12.27	9.84
Jul	1987	103.1	103.5	113.8	—	13.06	13.07	12.37	9.89
Aug	1987	103.7	103.8	114.4	—	13.03	13.07	12.34	9.90
Sep	1987	103.5	103.7	115.0	117.8	13.19	13.44	12.56	9.98
Oct	1987	104.0	104.1	115.3	—	12.96	13.06	12.52	9.95
Nov	1987	104.2	104.2	115.4	—	12.89	13.10	12.56	10.00
Dec	1987	104.1	104.1	115.4	118.7	12.78	13.14	12.62	10.05
Jan	1988	104.3	104.5	115.7	—	13.02	13.00	12.56	10.03
Feb	1988	104.4	104.6	116.0	—	13.13R	12.93R	12.55R	10.04
Mar	1988	104.7	104.9	116.5	119.4	13.14P	13.15P	12.55R	10.05R
Apr	1988	105.6	105.8	117.1	—	—	—	12.52P	10.10P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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NUEXCO REPORT NO. 238 FIGURES OF THE MONTH (May 31, 1988)	This Month (Report 238)	Last Month (Report 237)	12 Months Ago (Report 226)
Exchange Value ($US per pound U_3O_8)	15.40	15.75	17.00
US Premium for the Exchange Value ($US per pound U_3O_8)	0.60	0.25	.90
UF_6 Value ($US per kg U as UF_6)	44.75	45.25	47.75
US Premium for the UF_6 Value ($US per kg U as UF_6)	1.00	.50	2.25
Transaction Value ($US per pound U_3O_8 equivalent)	16.10	16.45	17.20
Loan Rate (Per Annum)	3.5%	3.5%	3%
Conversion Value ($US per pound U as UF_6)	1.80	1.80	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	7.0	5.6	4.1
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	.9	1.2	1.4
Near-Term Supply-Demand Ratio	7.8	4.8	3.0
Recent Uranium Sales:[3]			
Number of Transactions	6	1	6
Quantity of Material (Millions of pounds U_3O_8 equivalent)	1.5	<0.3	5.3
Nuexco SWU Value: ($US per SWU):			
at 0.3 tails assay	68	68	75
US DOE SWU Prices: ($US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6 [8]: ($US per kg U as UF_6)			
2.5 w/o U_{235}	409	414	450
3.0 w/o U_{235}	523	529	575
3.5 w/o U_{235}	639	646	702
4.0 w/o U_{235}	757	765	831

---

[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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NUEXCO

EXECUTIVE SUMMARY
REPORT 238
(All data as of May 31, 1988)

Exchange Value **\$15.40, down \$0.35**	The **Exchange Value** is **\$15.40** per pound U_3O_8, down \$0.35 since last month. The US Premium (relative to the Exchange Value) is \$0.60, up \$0.35 since last month.
UF_6 Value **\$44.75 down \$0.50**	The **UF_6 Value** is **\$44.75** per kg U as UF_6, down \$0.50 since last month. The US Premium (relative to the UF_6 Value) is \$1.00, up \$0.50 since last month.
Transactions	**Six** recent natural uranium sales are reported, involving approximately **1.5 million** pounds equivalent U_3O_8. Four of these sales involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **7.0 million** pounds U_3O_8 equivalent, up 1.4 million pounds since last month. Active spot and near-term **uranium demand** totals **900,000** pounds, down 300,000 pounds since last month. The spot and near-term **supply-demand ratio** increased to **7.8 to 1**.
Transaction Value **\$16.10, down \$0.35**	The **Transaction Value** is **\$16.10** per pound U_3O_8, **down \$0.35** since last month. The calculation includes 21 transactions involving a total of more than 2.6 million pounds U_3O_8 and equivalent UF_6 and covers a period of 5 months.
Loan Rate **3.5%, unchanged**	The **Loan Rate** is **3.5 percent** per annum, unchanged. No loan transactions are reported.
Conversion Value **\$1.80, unchanged**	The **Conversion Value** is **\$1.80** per pound U as UF_6, unchanged since last month. There were two secondary market tranactions for conversion services this month. Active demand totals 750,000 pounds U as UF_6.
SWU Value \$68, **unchanged**	The **SWU Value** at .3% tails assay is **\$68** per SWU, unchanged since last month. One secondary market SWU transaction is reported this month, involving less than 100,000 SWU. Two sales of low-enriched uranium sales were also concluded.

* * *

Australia	The Australian Labor Party is unlikely to debate the Three-Mine Policy at its upcoming conference, despite extensive media attention recently given the uranium industry.
Federal Republic of Germany	The Social Democratic Party won a majority in Schweswig-Holstein's May election, and has pledged to shut down all three operating nuclear plants in the state.
France	The recent release of three French hostages held in Iran has led to speculation that the French government may have made a third payment on the 1974 loan from Iran to finance part of the Tricastin-Eurodif enrichment plant construction.
Japan	Japan announced the May start-up of its 100,000 SWU-per-year prototype centrifuge enrichment plant.
United States	Long Island Lighting Company and the State of New York have reached agreement in principle to scrap the Shoreham nuclear power plant. The decision may affect the Seabrook plant in New Hampshire.
Analysis & Commentary	Contracting practices for natural uranium have changed since the 1970s as a result of the strengthened position of buyers. In particular, market-related pricing has become more prevalent, and flexibility provisions governing delivery quantities and schedules have increased in importance to buyers. This report discusses recent uranium contracting trends, as well as various contract term preferences by geographical region.

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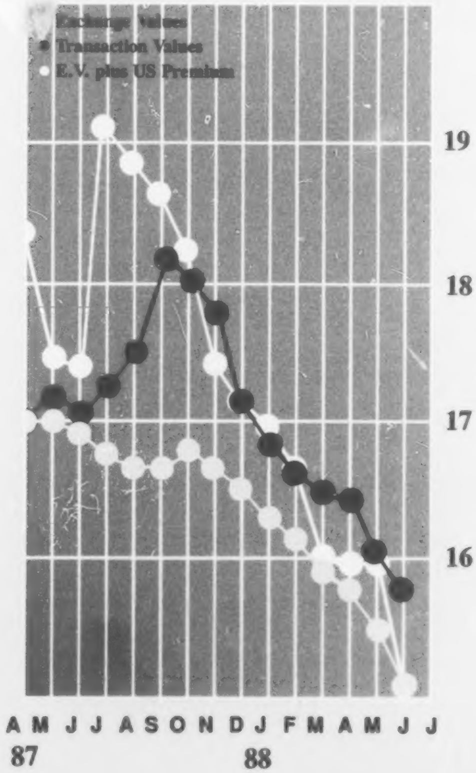

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NUEXCO

MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

July 1988 No. 239

R. GENE CLARK, *EDITOR* FRANCE A. HEAD, *ASSOCIATE EDITOR*

PRICING

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NUEXCO

MARKET VALUES SUMMARY

June 30, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE[1]	**\$15.10**/lb U_3O_8	7,225[2]	1,325[2]
US Premium[7]	**- 0 -**		
UF_6 VALUE[2]	**\$44.00**/kg U as UF_6	7,225[2]	1,325[2]
US Premium	**- 0 -**		
CONVERSION VALUE[3]	**\$1.80**/lb U as UF_6	0	1050
SWU VALUE[4] 0.3 tails assay:	**\$68**/SWU	265	30
LOAN RATE[5]	3.5%/annum	5,600	0

	\$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE[6]	15.80	2.4	15	4

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

[2] For either uranium concentrates or uranium hexafluoride.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers.
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of June 30, 1988)

Activity increased in the U_3O_8 market this month, as transactions involving over eight million pounds U_3O_8 for both near and long-term delivery occurred. The UF_6 market was dormant, although several utilities are evaluating offers. The secondary conversion market was also quiet, with only one transaction taking place this month. Non-DOE SWU dominated the secondary enrichment market, and four sales involving approximately 400,000 SWU are reported.

The **Exchange Value** is **$15.10** per pound U_3O_8, down $0.30 from last month. Eight U_3O_8 transactions are reported this month involving approximately 8.4 million pounds U_3O_8. Four met the conditions for inclusion in the Transaction Value calculation, and four were longer-term contracts. The four long-term sales, totalling more than seven million pounds U_3O_8, all involved US-origin material. The four spot market transactions were split between both US and non-US material. The non-US U_3O_8 changed hands at prices below those at which the US material sold, although no difference was present at month end. Although market volume was up, downward pressure on the Exchange Value continued.

The major influence on the U_3O_8 market this month was the long-awaited Supreme Court decision on the US Producers vs. DOE lawsuit, which was announced June 16 (see article on page 13). The Court reversed the judgment of the Court of Appeals and remanded the case to the lower courts for further fact finding. Although the US Producers have announced plans to seek a District Court hearing to determine whether enrichment restrictions can assure the industry's viability, most market participants do not foresee any early resolution of the court-related issues and are thus transacting business again.

In addition, the prospects for attaching the proposed settlement between the US Producers, the Reagan Administration, nuclear utilities and Congress to the Free Trade Agreement (FTA) implementing legislation, have now waned due to opposition by several influential House members. Whether these issues will be resolved at any time is uncertain, although immediate relief appears unlikely.

The **US Premium** for **U_3O_8** fell to **zero** this month, in response to the Supreme Court announcement which effectively signals that no enrichment restrictions will be imposed on non-US uranium in the near future, if at all. Most utilities which had previously indicated a preference for US material are now willing to purchase nearly any origin and are evaluating purchasing opportunities primarily from an economic standpoint. Suppliers of US origin material, many of which had been holding material in hopes of a favorable Supreme Court decision, now have become aggressive sellers. As a result, there appears to be little incentive or need to pay a premium for US material at this time, and several current transactions may be filled by US-origin material where the buyer has not restricted the origin.

* * *

Active supply of natural uranium (concentrates and UF_6) for spot delivery totals **7,225,000 pounds** U_3O_8 equivalent, an increase of 235,000 pounds from last month. **Active demand** for natural uranium also showed upward movement, increasing by 415,000 pounds to **1,325,000**. The near-term supply-demand ratio is 5.5, compared to last month's ratio of 7.8.

* * *

The **Transaction Value** is **$15.80** per pound U_3O_8, down $0.30 since last month. The calculation extends over a four-month period and includes 15 transactions involving 2.4 million pounds U_3O_8 equivalent.

* * *

The **UF_6 Value** is **$44.00** per kilogram U as UF_6, and has decreased by $0.75 from last month. No UF_6 transactions are reported during June, although two utilities were close to concluding purchases at the end of the month. While supply of UF_6 is less abundant than the current supply of U_3O_8, the presence of aggressive sellers has effectively weakened the UF_6 market.

The **US Premium** for **UF_6** decreased to **zero**, due to the same reasons mentioned above for the US Premium for U_3O_8.

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The **Loan Rate** is again unchanged at **3.5 percent** per annum, and no loan transactions transpired during June.

*　　*　　*

The **Conversion Value** remained at **$1.80** as the conversion services market was quiet. Only one transaction was reported involving a US utility. Two utilities, however, are expected to evaluate within the next few month secondary market conversion offers for the 1989 delivery period.

*　　*　　*

ENRICHMENT SERVICES AND SWU

There was no change in the SWU Value of $68.00, but activity was more pronounced in this sector of the nuclear fuel market than during the previous month. Four transactions are reported involving almost 400,000 SWU of non-DOE origin. One of these sales was concluded in late 1987, although delivery was scheduled for this month. In addition, at the end of June a US utility was finalizing a purchase of secondary market DOE-origin SWU from DOE. While a few US utilities may consider long-term SWU offers during 1988, the spot market for SWU has shifted to the 1989 time frame, both for contracting as well as for delivery. Thus, the secondary SWU market is expected to be relatively quiet for the next several months.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (June 30, 1988)	Last Month (May 31 1988)	12 Months Ago (June 30, 1987)	This Month (June 30, 1988)	Last Month (May 31, 1988)	12 Months Ago (June 30, 1987)
Australia (dollar)	19.22	19.07	23.43	49.96	49.58	60.92
Belgium (comm. franc)	575.68	550.00	640.15	1,497	1,430	1,664
Canada (dollar)	18.34	19.07	22.53	47.69	49.59	58.58
EEC (ecu)	13.26	12.65	14.91	34.46	32.89	38.77
Finland (markka)	65.40	62.30	75.21	170.02	161.96	195.53
France (franc)	92.75	88.91	103.11	241.13	231.16	268.07
FRG (mark)	27.51	26.44	30.90	71.53	68.74	80.34
Italy (lira)	20,416	19,605	22,410	53,078	50,970	58,263
Japan (yen)	2,007	1,904	2,478	5,218	4,949	6,443
Netherlands (guilder)	31.05	29.58	34.82	80.72	76.90	90.53
South Africa (rand)	35.11	34.34	34.53	91.27	89.27	89.76
Spain (peseta)	1,827	1,742	2,415	4,749	4,529	6,278
Sweden (krona)	94.55	91.45	107.92	245.81	237.75	280.56
Switzerland (franc)	22.80	22.10	25.68	59.28	57.45	66.76
UK (pound)	8.81	8.29	10.56	22.90	21.56	27.45
US (dollar)	15.10	15.40	16.90	39.26	40.04	43.94

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (June 30, 1988)	Last Month (May 31, 1988)	12 Months Ago (June 30, 1987)	This Month (June 30, 1988)	Last Month (May 31, 1988)	12 Months Ago (June 30, 1987)
Australia (dollar)	20.11	19.94	23.71	52.27	51.83	61.64
Belgium (comm. franc)	602.36	575.00	647.73	1,566	1,495	1,684
Canada (dollar)	19.19	19.94	22.80	49.90	51.84	59.27
EEC (ecu)	13.87	13.23	15.09	36.06	34.39	39.23
Finland (markka)	68.43	65.13	76.10	177.90	169.32	197.85
France (franc)	97.05	92.96	104.33	252.31	241.66	271.24
FRG (mark)	28.79	27.64	31.27	74.85	71.87	81.29
Italy (lira)	21,363	20,497	22,676	55,539	53,286	58,953
Japan (yen)	2,100	1,990	2,508	5,459	5,174	6,519
Netherlands (guilder)	32.49	30.93	35.24	84.47	80.40	91.61
South Africa (rand)	36.74	35.90	34.93	95.50	93.33	90.82
Spain (peseta)	1,911	1,821	2,444	4,969	4,735	6,353
Sweden (krona)	98.94	95.61	109.20	257.21	248.55	283.88
Switzerland (franc)	23.86	23.10	25.98	62.03	60.06	67.55
UK (pound)	9.22	8.67	10.68	23.97	22.54	27.78
US (dollar)	15.80	16.10	17.10	41.08	41.86	44.46

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb U as UF₆			per kg U as UF₆		
Country (currency)	**This Month (June 30, 1988)**	**Last Month (May 31, 1988)**	**12 Months Ago (June 30, 1987)**	**This Month (June 30, 1988)**	**Last Month (May 31, 1988)**	**12 Months Ago (June 30, 1987)**
Australia (dollar)	2.29	2.23	2.50	5.05	4.91	5.50
Belgium (comm. franc)	68.62	64.29	68.18	151.29	141.73	150.31
Canada (dollar)	2.19	2.23	2.40	4.82	4.91	5.29
EEC (ecu)	1.58	1.48	1.59	3.48	3.26	3.50
Finland (markka)	7.80	7.28	8.01	17.19	16.05	17.66
France (franc)	11.06	10.39	10.98	24.38	22.91	24.21
FRG (mark)	3.28	3.09	3.29	7.23	6.81	7.26
Italy (lira)	2,434	2,292	2,387	5,365	5,052	5,262
Japan (yen)	239.23	222.50	263.97	527.42	490.52	581.95
Netherlands (guilder)	3.70	3.46	3.71	8.16	7.62	8.18
South Africa (rand)	4.19	4.01	3.68	9.23	8.85	8.11
Spain (peseta)	217.73	203.62	257.22	480.02	448.90	567.06
Sweden (krona)	11.27	10.69	11.49	24.85	23.56	25.34
Switzerland (franc)	2.72	2.58	2.74	5.99	5.69	6.03
UK (pound)	1.05	.97	1.12	2.32	2.14	2.48
US (dollar)	1.80	1.80	1.80	3.97	3.97	3.97

SWU VALUE AND UF₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	SWU Value at 0.30% Tails Assay This Month (June 30, 1988)	**SWU Value at 0.30% Tails Assay Last Month (May 31, 1988)**	**UF₆ Value per kg U as UF₆ This Month (June 30, 1988)**	**UF₆ Value per kg U asUF₆ Last Month (May 31, 1987)**
Australia (dollar)	86.54	84.21	55.99	55.41
Belgium (comm. franc)	2,592	2,429	1,677	1,598
Canada (dollar)	82.60	84.22	53.44	55.42
EEC (ecu)	59.69	55.87	38.62	36.76
Finland (markka)	294.50	275.08	190.55	181.02
France (franc)	417.69	392.61	270.27	258.37
FRG (mark)	123.91	116.76	80.17	76.83
Italy (lira)	91,942	86,569	59,492	56,970
Japan (yen)	9,038	8,405	5,848	5,532
Netherlands (guilder)	139.83	130.62	90.47	85.95
South Africa (rand)	158.10	151.62	102.30	99.77
Spain (peseta)	8,225	7,692	5,322	5,062
Sweden (krona)	425.80	403.80	275.51	265.73
Switzerland (franc)	102.69	97.57	66.44	64.21
UK (pound)	39.67	36.62	25.67	24.10
US (dollar)	68.00	68.00	44.00	44.75

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month

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RECENT TRANSACTIONS[1]

URANIUM SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4301	1988-95	3,001-5,000	See Remarks	Producer	Utility	US Origin, Base Price Escalated
4317	1988	301-600	R[3]	Producer	Utility	US Origin
4323	1988-91	101-300	See Remarks	Intermediary	R[3]	US Origin, Base Price Escalated
4326	1990-95	1,501-3,000	See Remarks	Producer	Utility	US Origin, Price Related To Market
4327	1988	101-300	98-102	Utility	Intermediary	
4329	1988	less than 50	103-107	Producer	Intermediary	US-Origin
4332	1988	50-100	98-102	Producer	Intermediary	
4333	1989-92	1,501-3,000	See Remarks	Producer	Utility	Price Related to Market

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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CONVERSION SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks
4322	1988	301-600	R[3]	Intermediary	Utility	

ENRICHMENT SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4311	1988	50-100	93-97	Intermediary	Utility	Non-DOE	
4313	1988	101-300	98-102	Intermediary	Utility	Non-DOE	
4321	1988	101-300	R[3]	Intermediary	Utility	Eurodif	
4330	1988	50-100	93-97	Intermediary	Utility	Non-DOE	

LOAN TRANSACTIONS

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Loan Rate)	Lender	Borrower	Remarks

No loan transactions are reported this month.

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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CURRENT MARKET DATA

URANIUM SUPPLY
(June 30, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
87-1002	270	—	
87-1023	500	500 per year	1988-90
87-1061	1,000	700 per year	1988-91
87-1123	1,000	1,000 per year	
87-1141	500	200 per year	1989-92
87-1161	1,000	1,000 per year	UF_6
88-1000A*	350	—	1988
88-1000B*	320	—	1988, UF_6
88-1001	200	200 per year	1988-91
88-1026	250	—	1988
88-1033A	130	—	1988, UF_{6e}
88-1036	100	—	1988
88-1064	400	400 per year	1988-90
88-1078*	1,200	—	1988
87-1001	—	500 per year	1989 on
87-1005	—	250 per year	1988-95
88-1096A	—	290	1990, UF_{6e}
Total	**7,225**		
INACTIVE			
87-1019	1,000	1,000 per year	1988-91
87-1053*	100	500 per year	1989 on
87-1159	60	—	
88-1086*	75	—	1988
87-1130*	—	580	1989
Total:	**1,235**		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 88-1041.

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URANIUM DEMAND

(June 30, 1988)

Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Inquiries to Purchase: ACTIVE			
88-1035A	40	—	1988, UF_{6e}
88-1060	300	—	1988, U_3O_8/UF_6
87-1069	50	—	1988
88-1084	500	—	1988
88-1094*	35	—	1988
88-1100*	50	—	1988
88-1102*	350	—	1989
87-1134	—	200	1989
87-1172	—	500 per year	1990 on
88-1044	—	2,400	1991-95
88-1056	—	500 per year	1989-93, U_3O_8 or UF_6
88-1062	—	200 per year	1990-on
88-1089*	—	1,200 per year	1990-95
Total:	**1,325**		
INACTIVE			
87-1154A	80	—	1988, UF_{6e}
88-1014*	100	—	1988
88-1083*	800	—	1988
87-1163	—	160	1989-93
Total:	**980**		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1013, 87-1021, 87-1166, 88-1075A, 88-1080.

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LOAN SUPPLY AND DEMAND

(June 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1012	1,000	—	
87-1157	4,000	—	
88-1057	600	—	
Total:	**5,600**		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
Total:	**2,000**		

Available to Borrow:

No inquiries to borrow are reported.

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*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 87-1071.

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CONVERSION SUPPLY AND DEMAND

(June 30, 1988)

	Delivery Period[1] (Thousands of Pounds U as UF_6)		
Nuexco Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
ACTIVE			
No active supply reported this month			
INACTIVE			
87-1008	770	475	1988
Total:	**770**		
Inquiries to Purchase			
ACTIVE			
88-1034*	750	—	1990
88-1098*	300	—	1989
Total:	**1050**		
INACTIVE			
88-1021	65	—	
Total:	**65**		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(June 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
87-1058	50	—	1988
87-1068	200	—	1988,UF$_6$e
88-1033B	15	—	1988,UF$_6$e
88-1096B*		55	1990, UF$_6$e
Total	**265**		
INACTIVE			
87-1004	55	—	1988
87-1128	360	—	1988
88-1082	25	—	1988
Total:	**440**		
Inquiries to Purchase			
ACTIVE			
88-1035B	20	—	1988, UF$_6$e
88-1085*	10	—	1988
88-1077	—	70	1989-91
Total:	**30**		
INACTIVE			
87-1154B	20	—	1988, UF$_6$e
Total:	**20**		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 88-1074, 88-1075B.

AUSTRALIA

Australian Labor Party To Review Uranium Issues

During its biennial National Conference held in early June, the Australian Labor Party (ALP) quite unexpectedly decided to establish a committee to review the Party's uranium policies. This move was unexpected because, despite an aggressive lobbying campaign in the weeks leading up to the Conference, the ALP's right wing still lacked the votes needed to force major changes in the Party's uranium policy, and thus decided against pressing the issue. But when the Center-Left faction suddenly proposed a thorough review of all aspects of uranium policy, the Right was only too happy to agree. Although against the formation of this review committee and any possible liberalization of uranium policy, the left wing's opposition appeared largely perfunctory and lacked its usual, emotional, anti-uranium content.

It seems clear that the economic and common sense arguments advanced by proponents of further uranium development have, at long last, struck a sensitive nerve. Further support for pro-development advocates comes from changes in Canada and the United States. In Canada, the pending merger of the world's two largest, low-cost producers, Saskatchewan Mining Development Corporation (SMDC) and Eldorado Nuclear Ltd., will create a new behemoth, eliminating competition between the two long-time rivals. Buyers are concerned and ready to encourage new sellers, particularly the potential new Australian producers who have the reserves, ore grades, and financial resources to compete head-on with the Canadians.

In the USA, recent legislative, judicial, and political developments make it increasingly unlikely that US utilities will face meaningful restrictions on the use of non-US origin uranium. In turn, US utilities have become more willing to consider non-US sources of supply for the long term, and, with southern African uranium no longer an option for US buyers, Australia becomes the obvious and favored alternate to Canada.

There also appears to be a greater acceptance of uranium mining with Australia in general as evidenced by:

- tacit trade union acceptance that uranium mining is an established industry that is here to stay,
- overt support of the industry by the Northern Territory's traditional landowners who are now realizing the benefits of substantial royalty payments from the existing mines, and who may see an even greater bonanza from their 25 percent equity interest in the Koongarra project, and
- an operational record at Jabiru (Ranger) and Nabarlek that demonstrates that uranium mining does not threaten even the most environmentally sensitive areas when properly conducted.

If new uranium production operations are to be opened in Australia, the most likely candidates are (1) Pancontinental Mining's huge Jabiluka deposit in the Northern Territory, (2) Denison's Koongarra deposit also located in the Northern Territory, (3) Canning Resources' Kintyre deposit in Western Australia, and (4) Western Mining's Yeelirrie deposit, also in Western Australia. While reasonable arguments can be advanced on behalf of each company as to why it should be allowed to proceed ahead of the others, decisions in this area are more likely to be based on political realities than commercial or economic factors.

It does seem clear, however, that barring unexpected external events, the stage has been set for the ALP to alter its uranium policy, most probably by year-end, in the direction of further development and greater freedom for the various mining companies to strike their own commercial deals. Although such changes will likely be cloaked in the most cautious language so as to appear minimal, they now appear inevitable.

* * *

UNITED STATES

Supreme Court Issues Decision on Producers Lawsuit

The Supreme Court issued a unanimous decision in the US Producers vs. DOE lawsuit on June 15, 1988, reversing and remanding the lower courts' ruling that would have required DOE to restrict enrichment of imported uranium when the domestic uranium industry was found to be non-viable. The Court held that:

"Section 161 (v) does not require DOE to restrict enrichment of foreign uranium where such restriction would not achieve the statutory goal of 'assuring the maintenance of a viable domestic uranium industry', for the statute ties the amount of restriction to be imposed to the achievement of that goal. . . . Because we conclude that Congress did not intend to force DOE to impose enrichment restrictions where such restrictions would not achieve the statutory goal they were intended to achieve, the judgment of the Court of Appeals is reversed and the case is remanded for further proceedings consistent with this opinion."

The Supreme Court based its ruling on one issue — whether Section 161 (v) required DOE to restrict the enrichment of foreign uranium, regardless of whether any level of restrictions would make the domestic industry viable. In footnote eleven of the decision, the Justices added, "All we have resolved here is that the industry's nonviability does not necessarily trigger an obligation to impose enrichment restrictions. Whether DOE, in fact, has violated Section 161 (v) by failing to impose restrictions is a question to be addressed . . . on remand after an opportunity for presentation of further evidence and further briefing."

Because several issues remain unresolved, neither party emerged as victor in the lawsuit. A few hours after the Supreme Court announced its decision, the US Producers declared they would seek an immediate hearing in the Federal District Court to determine whether restricting the enrichment of foreign uranium will assure a viable domestic industry. In their official statement, the Producers cited the Supreme Court decision as an affirmation of their position. They will, however, now bear the burden of proving how restrictions will help the uranium industry.

It is uncertain how far the Producers will carry this issue, which has already been in litigation for three and a half years. The lower court, following a lengthly factual presentation, may define viability and again place the burden on DOE to establish by rule making, the level of restrictions that will ensure viability under the definition. This process could again result in appeals to higher courts and further prolong the proceedings.

Proposed Settlement

In the meantime, it appears less likely that the proposed settlement between the US Producers, the Reagan Administration, nuclear utilities and Congress, which includes sections of the Uranium Revitalization, Tailings Reclamation and Enrichment Act (S. 2097) and provides for a $750 million government program to purchase domestic uranium, will be attached to the Free Trade Agreement (FTA) implementing legislation. Considerable opposition in the House, primarily from House Ways and Means Committee Chairman Dan Rostenkowski (D-Illinois) and Representative John Dingell (D-Michigan), on procedural grounds has stalled its consideration. The proposed uranium legislation now is expected to be submitted for congressional approval as a stand-alone package, perhaps replacing the Senate Energy Committee's bill, S. 2097. It is questionable if this legislation can be enacted before ratification of the FTA, and if the FTA is entered into, the issues will become moot.

* * *

California Voters Approve Rancho Seco Operation

Residents of Sacramento, California recently voted in favor of continued operation of Sacramento Municipal Utility District's (SMUD) Rancho Seco nuclear plant. Two measures dealing with the plant were presented to voters in early June, and in each case continued operation was favored over shutdown. The 913-MWe Babcock and Wilcox PWR was shut down in late 1985, following an overcooling incident.

The first measure, sponsored by the anti-nuclear group, Sacramentans for Safe Energy (SAFE), called for the immediate shutdown of Rancho Seco as a nuclear plant. It was barely defeated with 50.5 percent of the voters opposing the shutdown. (A "no" vote was required to support nuclear power.) This narrow victory was primarily the result of an extensive and costly public relations campaign which focused on the economic advantages of nuclear energy. The campaign was aided substantially by the unusually dry past winter and spring in California. The resulting sharp reduction of available hydro-power made Rancho Seco's power essential, if SMUD were to avoid purchasing expensive power from other sources.

The second measure, which was sponsored by SMUD, proposed that Rancho Seco be authorized to run for an 18-month trial period, followed by a re-evaluation of its performance. This measure, which passed with 52 percent of the vote, includes a series of performance benchmarks (i.e., a 70 percent annual capacity factor, etc.) which the plant must attain or be subject to shutdown by SMUD's board of directors.

Although winning both votes, nuclear proponents can take little solace from the margins of victory, and it is generally conceded that if Rancho Seco experiences serious new problems on either the conventional or

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nuclear side of the plant, its future as a nuclear generating facility could be in jeopardy.

The situation at SMUD and Rancho Seco has been further complicated by other initiatives. Pacific Gas and Electric Company, in its bid (since rejected) to acquire SMUD, included a provision to close down Rancho Seco. Duke Power Company has expressed interest in operating (but not in owning) Rancho Seco on a fee basis, undoubtedly because of its experience with Babcock & Wilcox PWRs at its Oconee station in South Carolina. Quadrex Corporation, a small, California-based, nuclear plant engineering firm, has indicated interest in assuming management, operation, and ownership roles. Finally, Connecticut-based Consolidated Power Company has proposed converting the plant to a gas-fired station, and is expected to submit a formal proposal in September 1988.

* * *

Agreement Reached in Pacific Gas & Electric Company's Diablo Canyon Rate Case

In an unprecedented move, Pacific Gas and Electric Company (PG&E) has agreed with the State Attorney General and the California Public Utility Commission's Division of Ratepayer Advocates (DRA) to settle the Diablo Canyon rate case by basing the revenues from that nuclear plant on its actual electrical output. The settlement is subject to approval by the Public Utility Commission after public hearings. The DRA had sought to disallow, as imprudently incurred, some $4.4 billion of Diablo Canyon's $5.8 billion total cost. If approved, this settlement will resolve a dispute which began some years ago and might have extended well into the 1990s, exhausting all appeals.

In deciding on this approach, PG&E opted for getting on with business and reducing the uncertainties about when and how the complex legal, financial, regulatory, and political issues would be resolved. In separate but related actions, PG&E's board of directors reduced the quarterly cash dividend by 27 percent (from $0.48 to $0.35 per share) and agreed to take a one-time, $500 million after-tax charge aginst earnings.

The crux of the settlement agreement, however, is the concept of "performance-based pricing." Under this concept, a negotiated price is established for power produced by Diablo Canyon, and PG&E's net inome from the plant is based on how much electricity the plant actually produces, less the plant's operating expenses. The initial price is 7.8 cents per kilowatt-hour beginning July 1, 1988, with provision for annual adjustments thereafter. Obviously, the Diablo Canyon base revenue and PG&E's associated net income will be direct functions of the plant's capacity factor. Based on a price of 7.8 cents per kilowatt-hour, a 65-percent capacity factor would result in annual revenues of about $960 million. A 70-percent factor would equate to revenues of $1.03 billion, and 75 percent would equate to $1.1 billion.

In agreeing to such a settlement to recover and earn a return on its investment in Diablo Canyon (as opposed to the more conventional rate base approach), PG&E has signaled confidence in its ability to operate Diablo Canyon at production levels exceeding the industry average. Of equal importance will be PG&E's incentive and ability to control expenses, particularly manageable items such as operation, maintenance, and nuclear fuel, the costs of which are not passed through to ratepayers under this approach.

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WORLD URANIUM CONSUMPTION FORECAST (1988-2000)

This article summarizes the updated uranium consumption forecast for 1988-2000 presented in Nuexco's 1988 Uranium Market Study and Price Forecast.

* * *

The uranium consumption forecast in Nuexco's 1988 Uranium Market Study and Price Forecast covering the years 1988-2000 shows a 0.6 percent increase over last year's forecast. Over this period, uranium consumption is expected to total 1736 million pounds U_3O_8 compared to last year's forecast of 1726 million pounds. Nuexco's incorporation of an optimization of enrichment tails assay in uranium consumption calculations this year, less small reductions in electric generating capacity and average plant capacity factors, account for this modest increase. The source report gives forecasts for various market conditions and possible growth rates. However, in this article only the free market reference growth case is discussed. Table 1 presents a summary of Nuexco's uranium consumption forecast.

Table 1
SUMMARY OF NUEXCO'S WORLD CONSUMPTION FORECAST
Free Market Condition–Reference Growth Case

Consumption (million lbs U_3O_8)	
1988	**108.6**
2000	**151.5**
Between 1988 and 2000:	
• Annual average	**133.5**
• Total over period	**1735.6**
Average Annual Increase Over Study Period	
Million pounds	**3.58**
Percent	**2.82**

Methodology

The term "consumption", as used by Nuexco, means the amount of natural uranium, in the form of ore concentrates, that must be delivered to a conversion plant (where ore concentrates are converted to UF_6) in order to begin preparation of fuel assemblies, on a normal lead time prior to:

1. the commercial operation date (COD) of a given reactor if for an initial core, or
2. the periodic refueling date if for reload fuel.

For an initial core, Nuexco used a 30-month lead time prior to COD, and for reloads, an 18-month lead time prior to refueling. Nuexco considers uranium to be consumed when it enters the chain of fuel preparation operations. Thus, for a reactor starting commercial operation in 1990, the natural uranium for the initial core loading is classified as being consumed in 1987 or 1988. The amount of uranium is expressed as pounds U_3O_8 equivalent.

Principal Variables Affecting Consumption

Some of the main variables that affect the total uranium consumption forecast include:

- nuclear electric generating capacity in operation and annual additions
- nuclear plant design characteristics including the projected operating life, core loading, and thermal efficiency
- nuclear plant operating characteristics such as capacity factor and the cycle length between refuelings
- fuel cycle characteristics including the enrichment tails assay, the recycle of uranium and plutonium, fuel preparation lead times, and processing losses.

Nuclear Electric Generating Capacity

Nuexco's forecast for installed nuclear electric generating capacity incorporates assumptions regarding:

1. the termination of partially constructed but halted reactors, or reactors experiencing difficulty in obtaining final regulatory approval to operate,
2. the completion dates of reactors under construction, and
3. the construction and completion dates of planned and unplanned reactors.

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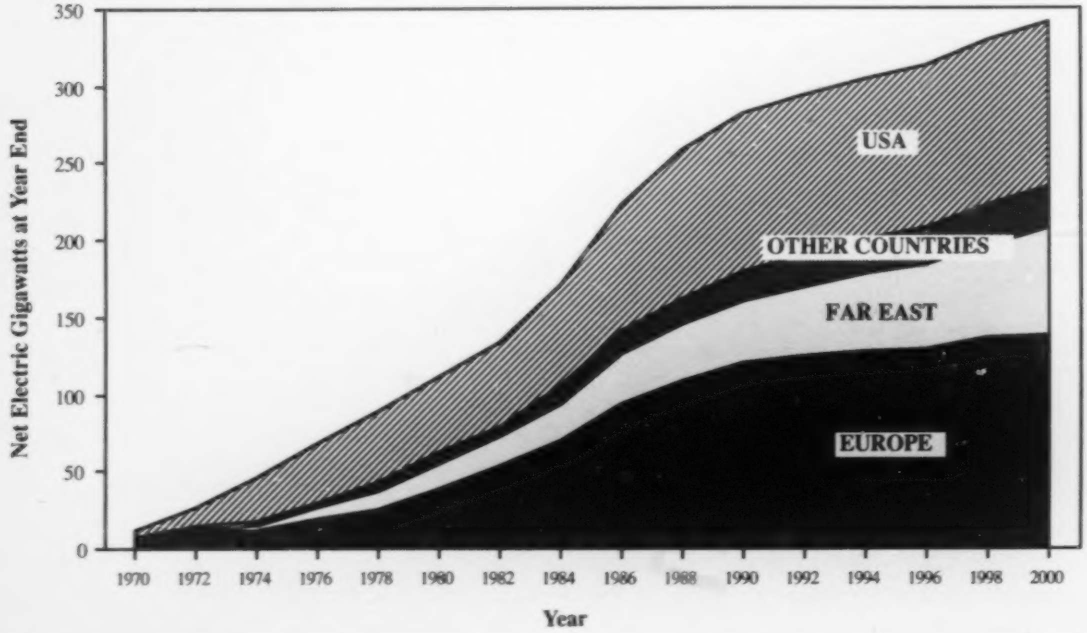
Figure 1
CUMULATIVE INSTALLED NUCLEAR GENERATING CAPACITY BY REGION



Nuexco's forecast shows a world growth from 247.6 net gigawatts electric (GWe net) at the end of 1987 to 340.5 GWe net at the end of 2000. This represents a 37.5 percent installed capacity increase over thirteen years, or an average of 2.5 percent per year. Over the previous thirteen-year period (1975 to 1987), the annual compound capacity growth rate was 13.9 percent. Figure 1 illustrates historical and projected cumulative installed nuclear electric generating capacity by region.

Some of the factors that could potentially affect these projected nuclear generating capacity figures are:

- a higher growth rate in electricity demand than currently anticipated,
- new applications for nuclear power such as process heat,
- greater public acceptance of nuclear energy,
- significant developments in nuclear plant safety and reliability,
- streamlined licensing and construction practices for nuclear plants,
- deregulation of the electric industry, particularly in the USA.

In 1987, Europe had 43 percent of the world's nuclear generating capacity. Public reaction to the Chernobyl accident, however, dampened the future nuclear power plans of several European countries and, consequently, over the period, Europe is projected to increase nuclear capacity at an average rate of only 2.1 percent per year. France will be responsible for half of this growth, contributing approximately 9300 MWe over the next five years. France also produced the largest percentage of its electricity generation from nuclear power than any other country during 1987, as shown in Figure 2.

From a regional perspective, the Far East will experience the most growth in capacity additions at a rate averaging about 4.9 percent per annum.

The major players in the "Other Countries" category include Canada (with four units under construction) and India (six units under construction), although Argentina, Brazil, Mexico and Turkey all have small, slowly

ANALYSIS AND COMMENTARY

developing nuclear power programs, the future of which will depend upon available financing. The capacity growth forecast for the Other Countries category is 4.1 percent per year.

Reduced load growth, financial constraints, licensing problems, regulatory changes and weak public support continue to plague the US nuclear industry. The USA held a 60 percent share in total nuclear generating capacity in 1974; its share is now about 36 percent and is decreasing. Between 1988-2000, the USA is expected to add 17,642 MWe of nuclear generating capacity, or about 1.4 percent on an annual average compound growth basis.

Table 2 shows the nuclear electric installed capacity for each region at the beginning and end of the study period.

Table 2
INSTALLED NUCLEAR ELECTRIC CAPACITY BY REGION

Region	1987		2000	
	GWe	%	GWe	%
Europe	106.0	42.8	138.5	40.7
Far East	37.1	15.0	69.0	20.2
Other Countries	16.0	6.5	27.0	7.9
USA	88.5	35.7	106.1	31.2
Total	247.6		340.6	

Figure 2
NUCLEAR PORTION OF TOTAL ELECTRICITY GENERATION BY COUNTRY IN 1987

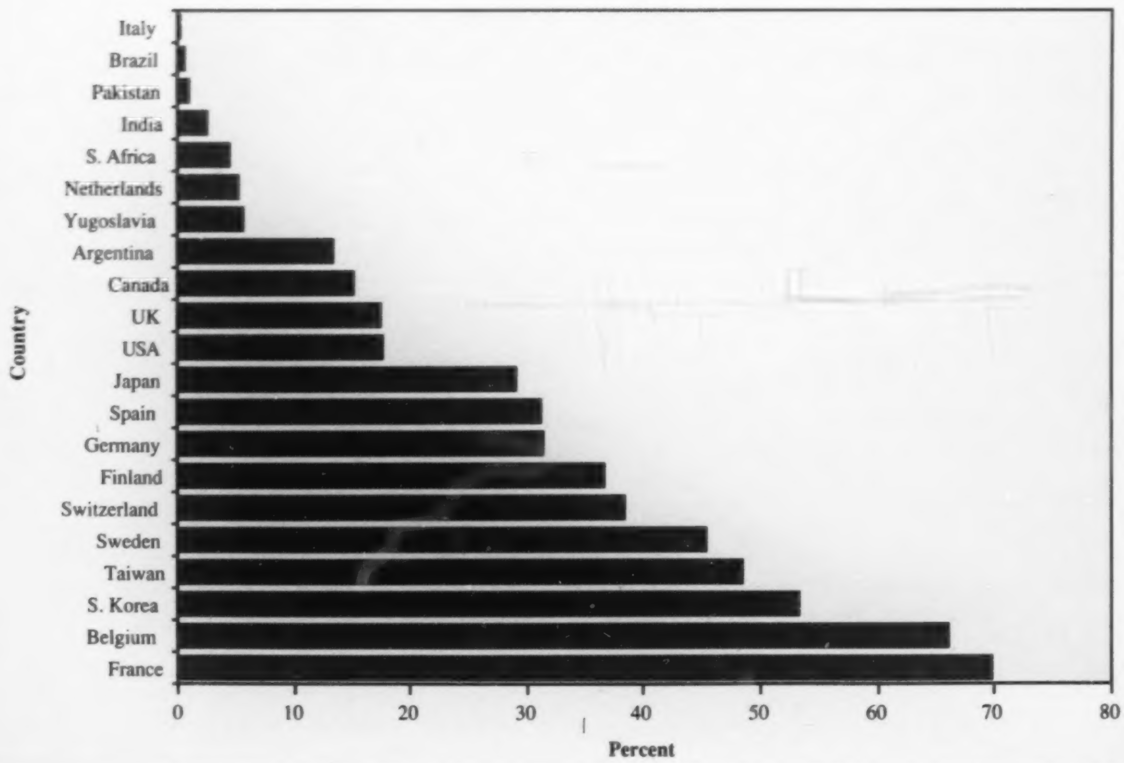
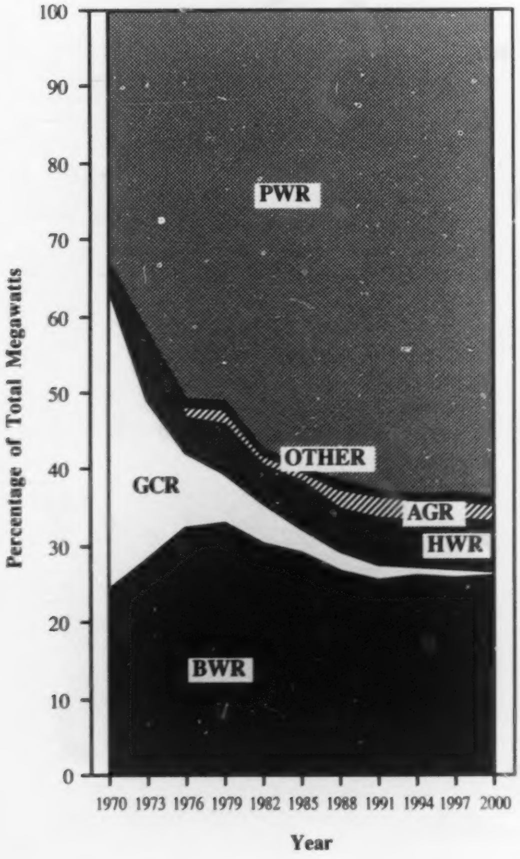


Figure 3
CUMULATIVE INSTALLED NUCLEAR GENERATING CAPACITY
By Reactor Type



In 1970, the gas-cooled reactor (GCR) was the dominant reactor type, although this has been gradually replaced by the pressurized water reactor (PWR). By 2000, the PWR is expected to account for approximately 64 percent of total nuclear electric generating capacity. The reference case forecast of installed nuclear electric generating capacity by reactor type can be seen in Figure 3.

Nuclear Plant Design Characteristics

Nuexco uses a 35-year plant operating life unless a different lifetime is experienced or planned.

Nuexco uses core loadings characteristic of each type of plant and sized to the reactor power rating.

Nuclear Plant Operating Characteristics

The capacity factor of a power plant is the ratio of actual electric production to its 100 percent capability. Known also as "plant factor" or "load factor", the capacity factor assumed to prevail for 1988 is based on the average capacity factor for the years 1985-1987 by reactor type and country. The nuclear power plant capacity factor, on a weighted average world basis, is therefore 66.9 percent in 1988, and assumed to be 71.9 percent in the year 2000.

Figure 4 shows the historical frequency distribution of capacity factor values by region. The Far East showed the highest capacity factor for 1987, with a mean of 77.2 percent. This figure is 23 percent greater than the corresponding figure for the USA. Also, in the Far East the lowest reactor capacity factor in 1987 was about 56 percent, whereas all other regions had at least one reactor with a zero capacity factor. One-third of the worlds reactors experienced a 77 percent or greater capacity factor in 1987.

On a worldwide basis, the weighted average capacity factor used in the consumption forecast is:

Year	Capacity Factor
1988	66.9%
2000	71.9%

In the USA, there is a substantial trend toward longer operating cycles between refuelings which are usually accompanied by greater fuel burnups. Since longer operating cycles theoretically decrease downtime percentage for refuelings, they generally should result in better capacity factors. In addition, they tend to increase uranium consumption slightly per unit of energy production, even in combination with greater fuel burnup.

Fuel Cycle Characteristics

This year's report incorporates an optimization of the enrichment tails assay in the uranium consumption calculations. In each year of the study period, the tails assay selected provides the minimum product cost based

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Figure 4
FREQUENCY DISTRIBUTION OF CAPACITY FACTORS BY REGION

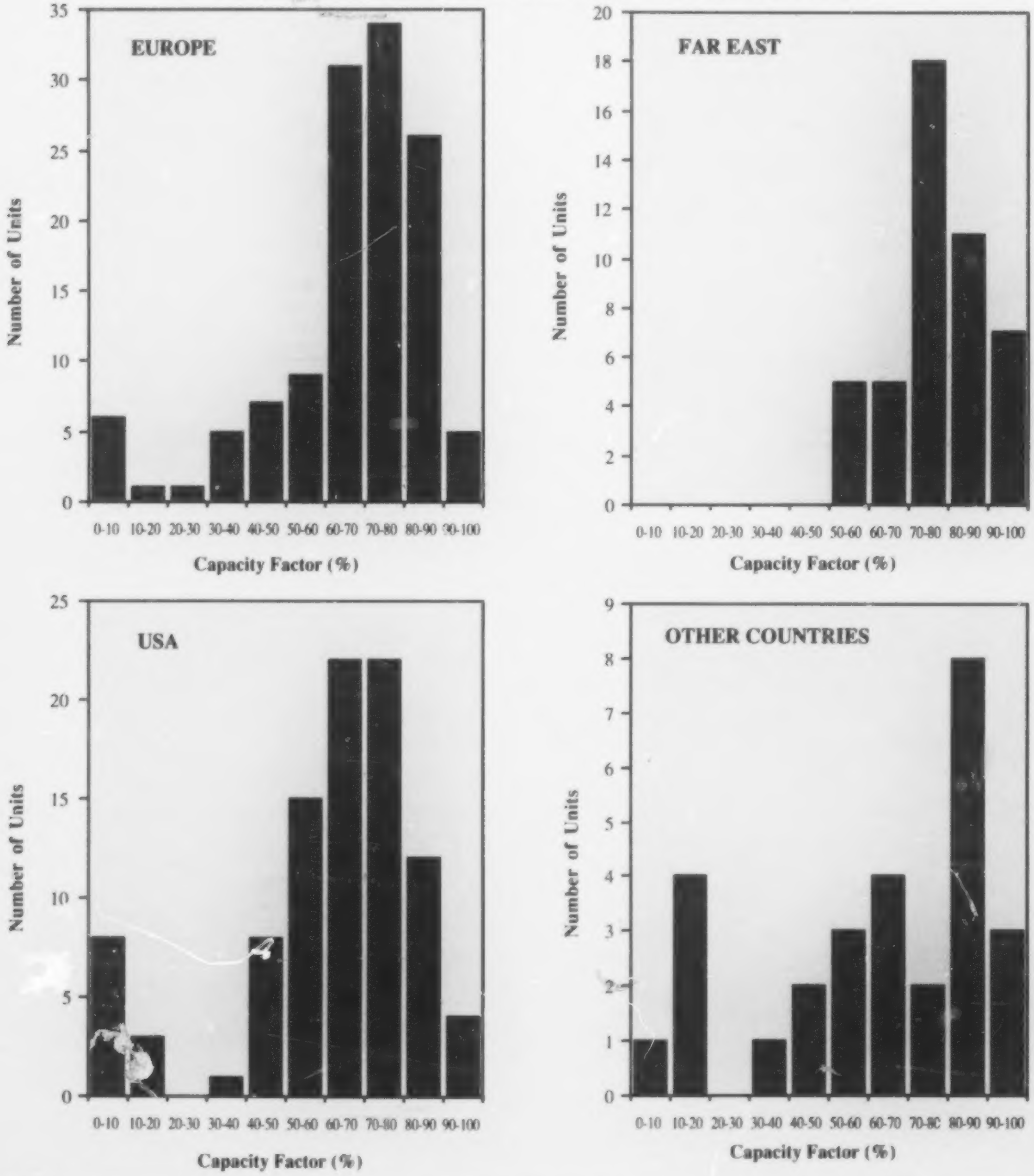

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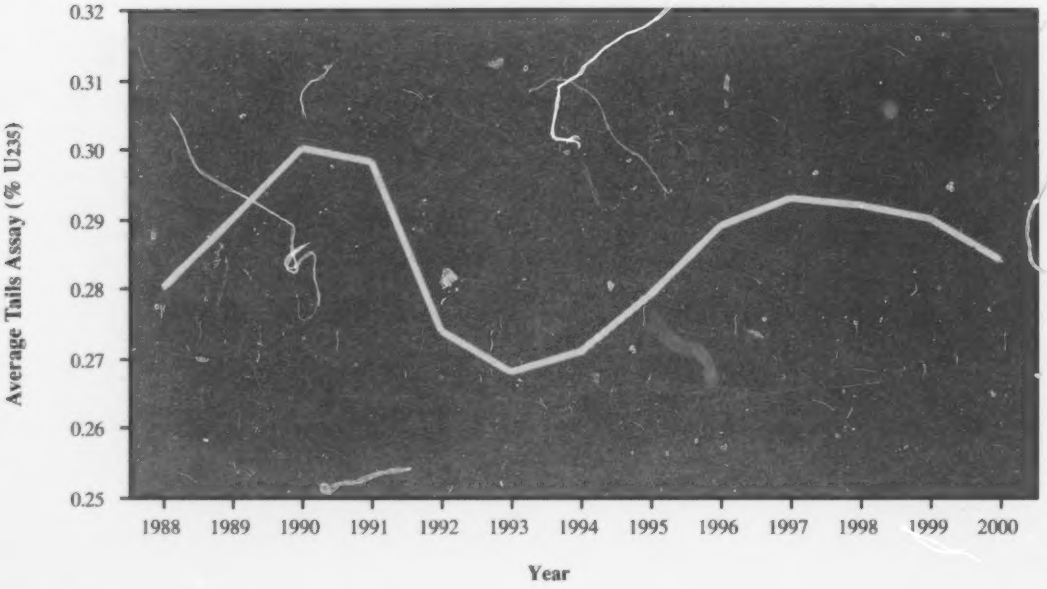
Figure 5
FORECAST OF ENRICHMENT TAILS ASSAY
Free Market Condition



on Nuexco's forecast of spot uranium prices and SWU prices.

Figure 5 shows the forecast for the enrichment tails assay for the free market case. Note that during the period 1990 through 1993 the tails assay drops from 0.3 percent to a little under 0.27 percent, holding down the rate of increase in uranium consumption. From 1993 to 1996, a notably large growth in consumption occurs, spurred primarily by:

- an increase in the tails assay from 0.268 to 0.289, which by itself increases consumption by 4.4 percent,
- a normal increase in enriched uranium needs as installed capacity grows,
- the assumption that the capacity factor will gradually increase,
- larger than average capacity additions in 1997-99 which, due to the lead requirements for fuel, accounts for an increase in uranium demand several years earlier.

Over the study period, the tails assay averages 0.285 percent.

Recycle of Uranium and/or Plutonium

The increased use of nuclear fuel reprocessing by non-US utilities will affect uranium material balances through additions to supply of recycled uranium (REPU) and reductions in demand for enriched uranium due to mixed uranium-plutonium oxide (MOX) fuels. Although current prices of uranium and enrichment services do not favor recycling on a purely economical basis, Argentina, China, France, Japan, West Germany, the United Kingdom and the USSR have committed to the reprocessing of spent nuclear fuel. Nuexco estimates that some 45 million pounds U_3O_8 equivalent, or 2.6 percent of total forecast uranium consumption, will be provided through existing reprocessing contracts.

Free Market Condition - Reference Growth Case

Total consumption over the study period is forecast to be 1736 million pounds U_3O_8. Uranium consumption in 1988 is 108.6 million pounds and 151.5 million pounds in 2000, averaging 135.5 million lbs per year. This corresponds to a 2.8 percent average annual growth rate. The top five user countries over the study period are:

United States	31%
France	20%
Japan	14%
Germany	8%
Canada	4%
Total	77%

Figure 6 shows projected annual uranium consumption by region. Europe is the number one regional consumer with requirements of approximately 745 million pounds U_3O_8 over the study period. France consumes the most uranium within that region, followed by West Germany and the U.K. The overall increase in demand over the thirteen years averages 1.2 million pounds/year, the equivalent of a compound growth rate of 2.3 percent per year.

The USA is expected to consume approximately 537 million pounds through 2000, showing a growth rate of about 0.9 percent per year.

In the Far East, consumption should average about 26.2 million pounds annually, with total consumption of approximately 341 million pounds. The annual growth rate for consumption in the Far East is 6.6 percent. Japan is clearly the primary consumer in the Far East, and also shows the highest growth rate in that region.

Comparison With Previous Year's Forecast

Some of the differences in the current and prior year forecasts are:

- This year, Nuexco utilized a year-by-year enrichment tails assay optimization procedure. The tails assay selection was based on minimizing the enriched product cost using the forecast natural uranium and separative work (SWU) prices for each year. This yielded a higher enriching tails assay than in last year's forecast (0.285 percent U_{235} compared to 0.25 percent in 1987). This alone causes consumption to rise by about 7.1 percent.
- Average projected installed electric generating capacity is 0.7 percent less than last year, thus reducing consumption by about the same amount.
- This year's average plant capacity factor over the study period is 69.4 percent, down 2.3 percent from last year's value of 71.0 percent. For the reference growth forecast, reload fuel accounts for about 95 percent of total estimated consumption; therefore, the capacity factor reduction lowers total consumption by about 2.1 percent.
- Enrichment/burnup relationships and other technical changes in the consumption model reduce consumption by about 3.4 percent.

All together, these differences result in a net 0.6 percent increase in the total consumption forecast.

Comparison of Nuexco Forecast with Other Forecasts

The Energy Information Administration (EIA) report entitled "World Nuclear Fuel Cycle Requirements 1987" provides some data on its own and other uranium consumption forecasts.

Based on the available information, the major differences in the EIA and Nuexco reports are:

- Nuexco uses a higher tails assay value (averaging 0.285 percent versus EIA's 0.256 percent).
- Nuexco's electric generating capacity factor is about 3.4 percent higher than EIA's, which affects reload fuel requirements.

After adjustment for the above variables, Nuexco projects a 4.5 percent higher level of consumption than EIA.

The Uranium Institute projection for 1988-2000 is 1628 million pounds total uranium consumption. The largest difference in the Uranium Institute and Nuexco forecasts results from the Uranium Institute using a much lower tails assay (0.225%). This accounts for a 12.2 percent difference in consumption. The Uranium Institute has a higher projected nuclear power capacity than Nuexco, but capacity factors are similar. After adjustments, the Uranium Institute has a 1.2 percent higher consumption forecast than Nuexco.

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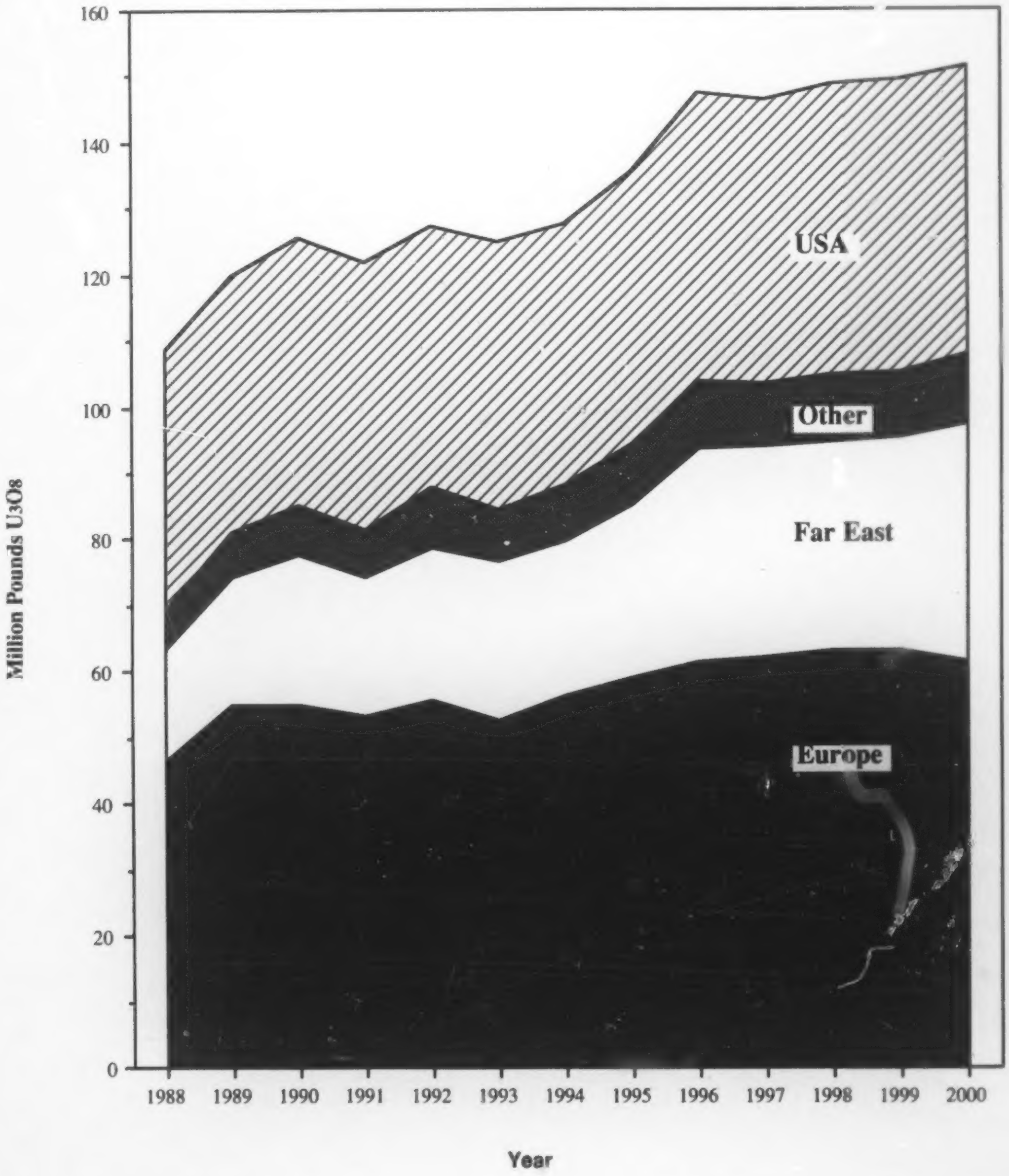
Figure 6
FORECAST OF ANNUAL URANIUM CONSUMPTION BY REGION
Free Market Condition - Reference Growth Case



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PRODUCTION TECHNOLOGY - SHAFT DRILLING

Introduction

Many individual factors have contributed to the evolution of uranium production technology and the increasing efficiency of exploitation. These improvements have allowed the industry to maintain a high level of production in spite of decreasing uranium prices. This process is ongoing, and additional improvements may be anticipated in the future.

An emerging technology which is providing an increasing contribution to uranium production is radiometric sorting of uranium ores (see Nuexco Report No. 232). In addition, shaft drilling and the related fields of raise and tunnel boring are finding increasing application in uranium mining systems and in systems being developed for the disposal of nuclear waste.

Shaft drilling has even played a role in the construction of a nuclear power plant. The Seabrook plant in New Hampshire utilizes fourteen drilled shafts in its cooling water system. Located one mile offshore in the Atlantic Ocean, these shafts connect with the plant by means of a tunnel three miles in length. The shafts were drilled from a jack-up barge in 50-75 feet of water and reached a total depth of about 160 feet.

This review of shaft drilling covers the history of its development, current technology and equipment, and its application to uranium production.

History

Big-hole shaft drilling dates back to the mid-1800s in the coal mining industries of the Netherlands and Germany. By the early 1900s, the Honigmann method (Figure 7), which incorporates most features of current methods, was being used in Germany to drill through soft, water-saturated sediments to depths in excess of 1300 feet, with diameters of up to 24 feet. Average progress was reported to have been in the range of 30 to 60 feet per month while costs were approximately $750 per foot.

A number of shafts were drilled in the USA in the 1930s with calyx drills - blunt drill pipes rotating on small chilled-steel shot which were poured into the bottom of the hole. These drills actually cut a large-diameter core which had to be broken off and hoisted out of the drill hole. Diameters ranged up to six feet, depths to 1200 feet,

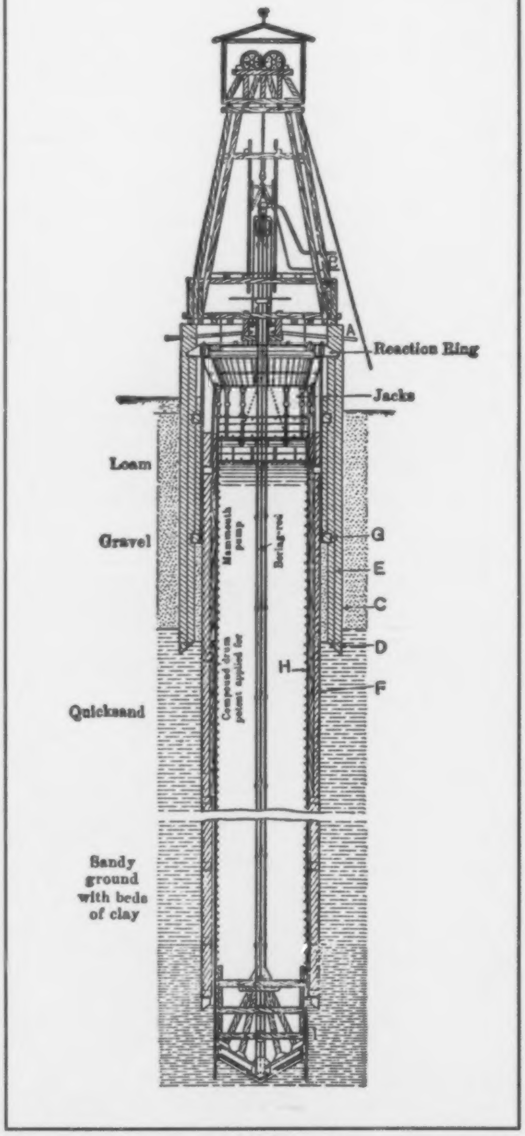

Figure 7. ***Honigmann Method.*** *Mammoth Pump and Borer. Shafts IV and V, Rheinpreussen Colliery, Germany. A, Suction Pipe and Overflow; B, Compressed Air; C, Caisson: D, Shoe; E, Anchor Rods; F, Compound Lining; H, Cast-iron Lining (Riemer).*

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progress to 150 feet per month and costs averaged about $20 per foot.

The late 1950s saw a rapid expansion of big-hole drilling in the USA as eastern coal companies tried out this new technology. The construction of liquified petroleum gas (LPG) storage caverns where some fifty 42-inch diameter access shafts were drilled during the period of 1956-1965 provided additional impetus to the development of shaft drilling.

The cessation of atmospheric nuclear weapons testing in the late 1950s caused a surge of big-hole drilling at the Nevada Test Site, which has been the center of research and development activities for big-hole drilling ever since. Over 450 large-diameter holes have been drilled on the test site, the deepest of which was drilled to 5050 feet and was six feet in diameter.

Phillips Petroleum was the first US uranium producer to utilize big-hole drilling. In 1958, Phillips drilled two shafts to depths of 930 and 1432 feet at its Grants, New Mexico operation. Each shaft had a drilled diameter of 46 inches (four separate passes were required to reach this size), and a cased diameter of 36 inches. The deeper hole was completed in 64 days and the shallower hole in 50 days. Kermac Nuclear, Rare Metals Corporation, and Union Carbide were other early users of big-hole drilling in the US uranium industry. Costs ranged from $50 to $100 per foot and excellent progress of up to 200 feet or more a week was frequently made for shafts up to 48 inches in diameter. These smaller shafts were used chiefly for ventilation. Depths were usually moderate - 600 to 1000 feet.

In 1963, two trapped coal miners in a Pennsylvania mine were rescued through a 26-inch diameter hole drilled to an air pocket at a depth of 350 feet. Although the pocket was not intersected until the third attempt, the operation is credited with providing impetus and experience to big-hole drilling. The South African Chamber of Mines also developed mine rescue capability through big-hole drilling and completed 700 feet of a 25-inch diameter hole in five days.

Throughout the 1960s, drill hole diameters increased substantially and, in 1970, Kerr-McGee Corporation completed a 16-1/2- foot diameter drilled shaft to a depth of 784 feet in the Ambrosia Lake area of New Mexico. The shaft was drilled and lined in less than six months and marked the development of Kerr-McGee's ninth uranium mine in the district.

Union Carbide, one of the first major US uranium producers, utilized big-hole drilling for all access and ventilation shafts at its Thunderbird and Rox projects in the Gas Hills area of Wyoming. These projects were developed in 1963 and 1964, respectively, at depths of about 400 feet. The hoisting shafts were drilled to a diameter of 60 inches and lined with 48-inch casing. The 60-inch holes were drilled in a single pass with a three-stage (26", 48", and 60") bit. While drilling and casing costs totaling about $178 per foot were slightly higher than costs for a comparable conventional shaft, timing considerations imposed by the Atomic Energy Commission's schedule of allocation provided an incentive for quick development. The mines had a production capability of 250 tons of ore per day through each of the 48-inch shafts.

One of the more recent major shaft drilling projects undertaken for uranium production was the Crown Point project, a joint venture of Wyoming Mineral Corporation and Conoco, Inc. This project included three closely-spaced shafts, one at 120 inches in diameter and two at 72 inches in diameter, all drilled to a depth of about 2200 feet near Crownpoint, New Mexico in 1980-1981. It took 363 days to drill and case all three shafts — an average rate of progress of 18 feet per day.

The largest drilled shaft in the free world was completed in Australia as a ventilation shaft for a nickel mine in 1983. At 14 feet in diameter and 2460 feet in depth, some 380,000 cubic feet of rock was drilled and pumped to the surface. Drilling required 328 days for an average rate of progress of 7.5 feet per day. Total cost was US $15 million, or $1,600 per foot. While this rate and cost are not particularly good, the exploration shaft for this mine required almost three years to sink using the conventional method.

Technology and Equipment

The actual drilling process for big holes requires a combination of massive, powerful, finely-machined equipment rarely encountered in other applications. It requires cutters, cutter heads, stabilizers, collars, drilling pipe, and drilling rigs of the largest sizes to operate as a unit within very narrow tolerances in an inhospitable environment. The basic technology of big-hole drilling has been borrowed, in most cases, from the petroleum industry and adapted to more specialized needs. This technology continues to evolve through innovation, particularly in the areas of cutter design, cuttings removal, and lining.

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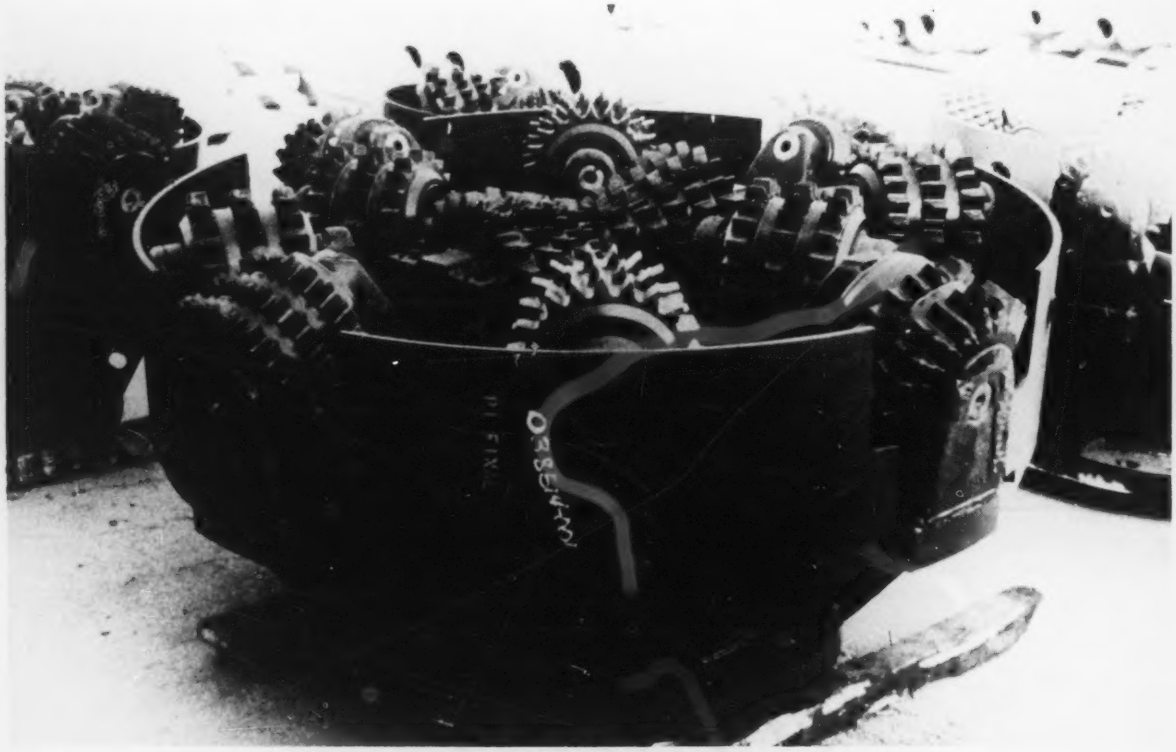

Figure 8. Cutter head with milled tooth cutter. *(Photo courtesy of the Earth Mechanics Institute.)*

Cutters and Cutter Heads

Drill head cutters consist of three general types: milled tooth, tungsten carbide insert, or disc. Milled tooth cutters are, in essence, a series of steel wedges formed on a tapered, circular core which "rolls" across the area to be cut and indents and craters the rock. (See Figure 8.) These cutters are generally applicable to softer formations because bit wear can be excessive in harder material. Tungsten carbide inserts are set into tapered rollers and may be used in harder, more abrasive formations. Disc cutters are shaped like a pair of cymbals and also roll across the area to be cut, indenting and cratering in a continuous band. Disc cutters tend to produce larger chips than toothed cutters, an advantage in breaking the rock, since less energy is consumed per unit of rock broken. As a rule, energy input in rock breakage is inversely proportional to the size of the pieces produced.

A series of cutters are usually emplaced upon a drill head in such a manner as to provide coverage of the entire rock face as the head rotates. Cutter types and sizes may be combined for optimum cutting and coverage. The drill head configuration may be a flat, domed, or narrow cone. In general, flat configurations are amenable to limited deviation and conical shapes provide increased penetration rates.

Drill Pipe

Drill pipe for big hole drilling serves two purposes: 1) transmitting rotational force to the drill head, and 2) channeling drilling fluids and/or cuttings. Standard oilfield drill pipe in 30 to 60-foot lengths is used. The outside diameter is usually 13-3/8 inches and each length of pipe is fitted with a welded tool joint at each end. The tool joint is simply a short length of pipe flattened on opposing sides with tapered threads on the outside end. The flattened portion serves as a grip when connecting, disconnecting, or rotating the pipes, and the tapered threads enable the pipes to be screwed together quickly.

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Stabilizers and Collars

A grouping of stabilizers and collars is installed on the drill pipe above the drill head. The stabilizers limit horizontal movement of the drill head; one is located immediately above the drill head, the other is located further up on the drill pipe above the drill collars. The stabilizers comprise several rollers, mounted vertically upon a circular shell, and are set at the exact gauge of the drill hole. Drill collars provide much of the weight required to force the drill bits into the rock. These collars, which look like steel doughnuts fitted on the drill pipe, are cast from steel or iron and may weigh up to five tons each.

In big-hole drilling applications, it is not unusual for the total weight of the drilling assembly — cutter head, stabilizers and collars — to exceed 250 tons. This weight forces the cutters into the rock causing displacement, dislodging, crushing, or spalling of fragments. As a general rule, harder rocks require more force to produce the same sized chips as those produced in softer rocks.

Drill Rigs

Two types of drill rigs are used for big-hole drilling: standard oil field rigs modified to meet the specific requirements of big-hole drilling, and rigs specially designed for those requirements.

In either case, the requirements are substantial and result in rigs of immense capabilities.

Standard oil field drilling rigs are known by their tall derrick structures mounted over the drilling platform. These structures allow the drill pipe to be broken into long lengths when "tripping" (moving the bit into or out of the hole) and stored within the structure itself. Specially-designed rigs are shorter than standard rigs and may incorporate a twin-tower design which supports a hydraulically-controlled head block.

These rigs must have:

- a large lifting capacity for the drill string as well as for lining emplacement (up to as much as 2,000,000 pounds),
- the ability to impart rotational force to the cutter head (up to as much as 500,000 ft-pounds), and
- the capability of handling many kinds of specialized service functions.

Lifting capacity is a function of the combined capacity of the derrick structure and the draw works hoist, while the rotational capacity is provided by a rotating table which grasps and turns the drill pipe at the tool joint. The table may be driven by either chain or hydraulics, but, in either case, some limiting feature is usually provided so that excess torque will not destroy the table or the drill string.

Service functions include provision for bit replacement, mud handling, deviation surveying, lining installation, fishing for lost tools, and grouting.

CUTTINGS REMOVAL

The success of the drilling process can be measured by the difficulties encountered in the removal of cuttings. Large cuttings, indicative of efficient drilling, may be difficult to remove from the hole, and faster drilling progress requires that more material be removed from the hole per unit of time.

Cuttings removal is invariably accomplished by flushing the drill hole with some mixture of air, water, mud, and additives. Flow rate and density are the primary variables. Obviously, higher flow rates and higher densities can remove more and larger particles.

In the early days (1950s) of shaft drilling, most drill hole flushing used the direct method of forcing a fluid down the center of the drill string and up the annulus between the drill string and the hole wall. As hole diameters increased, however, from a few feet to many feet, the difficulty of maintaining a high upward velocity in the drill hole became almost insurmountable. (Pumping requirements increase in relation to the square of the hole diameter.) Consider, for example, a three-foot hole drilled with 6-3/4-inch pipe and an eight-foot hole drilled with 13-3/8 inch pipe. To maintain equal up-hole velocities the eight-foot hole would require seven times the pumping capacity. The velocity requirements also increase for larger particles. These relationships led to a reconsideration of conventional methods, and resulted in the development of "reverse" circulation drilling wherein the drilling fluid moves down the drill hole and up the drill pipe. The small inside diameter (ID) of the drill pipe allows very high fluid flow velocities to be achieved inside the pipe. Of course, cutting size is limited to the ID of the pipe, which for 13-3/8-inch pipe amounts to about 11 inches.

Air lift is the principal means of producing this type of circulation. This method requires air to be introduced under pressure into the drill pipe at some distance below the fluid level outside of drill pipe. The rising air bubbles reduce the density of the fluid within the pipe, stimulating an upward flow. The cuttings-laden fluid can then be pumped from the top of the drill pipe to a cuttings disposal area. In most cases, particularly where some type of fluid additives are used, it may be desirable to separate the cuttings from the fluid so that the fluid may be reused. This separation usually entails two processes: screening and settling. Screening removes the larger particles, and settling allows the smaller particles to gravitate to the bottom of, for example, a mud pit while the clean fluid flows out the top of the pit. Cyclone separators have also been used effectively for this purpose.

The most common fluid used in big-hole drilling is water and the most common additive is a finely-ground bentonitic clay which swells appreciably upon contact with water. The clay, in essence, seals the sides of the drill hole and prevents loss of the drilling fluid into the cracks and interstices of the rock. Water and mud also exert hydrostatic force against the sides of the drill hole which prevent or minimize caving and sloughing of loose material.

During the drilling process, the drilling fluid flows downward through the drill hole and sweeps across the bottom of the hole to the drill pipe intake. This sweeping action cleans the chips from the bottom of the hole on a continuing basis. The bottom-hole configuration also affects cuttings removal. A flat face requires relatively high velocities which are difficult to achieve on the perimeter of the hole, while a sloping face provides a gravity-assist.

In a number of cases, air alone has been used as the drilling medium to remove cuttings and to cool the cutters. A water mist, detergents, or other additives can enhance the carrying power of air. Generally, air is used only in relatively dry, unfractured ground.

A recent modification of the reverse circulation system utilizes double-wall drill pipe to maintain all fluid movement, up and down the hole, inside of the drill string. This method reduces hydrostatic pressure on the drill hole wall since only the bottom portion of the hole must be filled with fluid.

LINING

Drilled shafts, which cause little if any deterioration of the material penetrated, may require a lining either to ensure wall stability or to limit the inflow of water. Historically, this lining has usually consisted of steel casing, butt-welded and lowered into the drill hole a segment at a time. Approximate thirty-foot lengths are common.

The design and setting of steel casing poses certain problems.

- Hydrostatic forces are much greater at depth (some shafts have been cased to over 5,000 feet).
- The weight of the casing may exceed the lifting capacity of the rig.

The problem of high hydrostatic loads at depth may be addressed by varying the casing thickness, adding stiffener rings, or some combination thereof. Casing thickness is usually in the range of 1/2 to 3/4 inches near the top of the hole and as much as 1-3/4 inches near the bottom of the hole. Stiffener rings may vary in width, thickness, and spacing depending upon pressure. A safety factor of 50% is usually added to the expected pressure in order to provide some margin for design or construction errors.

When the total weight of the casing exceeds the lifting capacity of the rig, it is necessary to "float" the casing into place. First, the down hole end of the first casing is fitted with a hemispherical bulkhead and lowered into the drill hole which is still filled with drilling mud. Some drilling mud then is pumped into the casing to force it further down the hole so that it floats at an appropriate and convenient level. Buoyancy is created by maintaining the fluid level inside the casing at a lower level than the fluid outside the casing. The casing need not be entirely self-supporting in this way since the rig is available to assist with the process. The next section of casing is lowered onto the floating casing, matched for alignment, and butt-welded (either manually on semi-automatically). More mud then is pumped into the casing to lower it for the next segment and the process is repeated.

It is important to recognize, however, that the casing must be designed to withstand the pressure differentials created by the floating process as well as in-place hydrostatic and grouting pressures.

Grouting pressures are encountered after the casing is emplaced the full length of the drill hole. It is then necessary to seal the annulus between the casing and the drill hole with concrete (or grout) in order to prevent water flow up or down the hole and to provide additional lining strength. Grout is pumped into the annulus in a series of stages from bottom to top through pipes installed in the annulus. The grout, being heavier, displaces the mud/water mixture progressively. Additional grout fittings are provided at intervals throughout the casing for final checking and sealing after the interior of the casing has been dewatered.

A number of casing collapses have been recorded, including:

- At Bokum's Marquez project, which was funded primarily by Long Island Lighting Company (LILCO) for fuel supply at Shoreham, several ventilation/service shafts in the range of five to six feet in diameter were to be drilled. The first such shaft was drilled 78" in diameter to a depth of 2080 feet; a 60" casing was to be installed. For additional strength, the steel casing was fitted with channel stiffeners. Provision for grouting was made with a single grout line guide which was attached to the casing at notches made in the stiffening rings. This was done to minimize the outside diameter of the combined elements. During flotation of the casing for installation, a 40-foot joint of casing collapsed, apparently initiated by the notch in the stiffening ring. The casing flooded, overloaded the rig hoisting system (which failed), and fell 100 feet to the bottom of the hole. Repairs were attempted, but an effective water shutoff was never achieved and the shaft was never completed.

- In 1982 at a lead mine in Missouri, the steel casing for a 112-inch diameter by 1350-foot deep drilled shaft failed at a depth of about 800 feet during dewatering. After several unsuccessful attempts to seal the crack by grouting, a team of saturation divers was brought in to weld a patch over the crack. The logistics of the situation were formidable: a saturation chamber on the surface provided living quarters under pressure for the duration of the job, a submersible diving chamber provided transportation from the surface to the depths of the shaft, and an underwater welding habitat provided a working platform sealed by inflatable packers. After inflation of the packers, high-pressure air expelled water from the habitat. The crack was successfully repaired in 15 days, with the decompression requirement of 24 hours per 100 feet of depth accounting for the majority of that time (8 days).

Deviation Control

Verticality and straightness parameters are of primary concern for mine shafts dedicated to hoisting, since the hoisting ropes should hang free and clear of all obstructions and the horizontal forces on high-speed conveyances and their supports must be limited. These requirements do not apply for ventilation shafts. The installation of steel shaft linings also allows only minimum tolerance in alignment.

While drilling technique has a definite impact on hole deviation, the physical characteristics of the formation being penetrated are the principal cause of deviation. Drill holes tend to orient themselves perpendicularly to the bedding planes of the rock being drilled. Thus, in easterly-dipping strata, one would expect a drill hole to deviate to the west. The outlook for minimum deviation is poor in steeply-dipping rocks, particularly if the layers are thin and of varying hardness.

The four general methods of limiting deviation in big-hole drilling are 1) "steering" the drill bit; 2) guiding the drill bit by use of a small-diameter pilot hole; 3) stabilizing the drill string; and 4) utilizing the natural "plumb-bob" effect of the drill string.

Steering is typical of small diameter drill holes where a whipstock or in-hole directional bit may be used to direct the hole in the desired direction. While rarely used in big-hole drilling, steering, by means of an off-center stabilizer, has been reported.

Small diameter pilot holes have been used extensively in big-hole drilling to ensure proper direction and alignment at minimal cost. In many cases, pilot holes have been reamed one or more times to complete large diameter holes with rigs of minimal torque capabilities. To use a pilot hole as a guide hole, it is only necessary to provide a short "stub" on the bottom of a drill bit. This stub rotates within the pilot hole and guides the larger bit. Specialized, continuous systems of directional drilling are now available, and are expected to play an increasing role in shaft drilling.

Stabilization of the drill string is controlled by a series of circular stabilizers mounted above the cutter head on the drill string.

The natural plumb-bob effect of the drill string itself can be used effectively only when the string is in significant tension. Thus, more weight is added to the bit than that needed for penetration and the rig is actually lifting on the drill string at all times. During shaft drilling at the Crown Point uranium project in New Mexico, for example, only 30 percent of the drill string weight was applied to the bottom of the hole. Horizontal displacements for the three shafts were 1.03 feet, 1.33 feet and 0.84 feet at final depths of about 2200 feet.

In most cases, shaft drilling alignment is determined periodically with down-the-hole survey instruments common to the petroleum industry.

Operating Characteristics

Mechanically excavated mine openings have several advantages over those completed by conventional methods.

1. Conventional drill-and-blast methods are cyclical operations which require personnel to vacate the working

area prior to detonation of the explosive charges. When drill-and-blast operations are being conducted simultaneously in a number of adjacent areas, substantial coordination is required in order to minimize waiting times. Continuous methods of excavation require little coordination with adjacent areas and can rapidly build to an efficient, ongoing routine.

2. Mechanically-excavated openings exhibit smooth surfaces which provide for highly-efficient flows of ventilation air and which require much less initial ground support than their conventional counterparts. Blasting operations, even when carefully controlled, fracture and weaken the surrounding rock, necessitating an ongoing maintenance program. Maintenance requirements are likely to be much less in a drilled shaft since the integrity of the rock is usually unaffected by the drilling process. It is notable, however, that conventional methods are much more capable of adapting to changing conditions than are mechanical methods.

3. The safety advantages of a drilled shaft, during both construction and operation, may be substantial. During the period 1971-1978, 44 fatalities were recorded on shaft sinking projects in the USA, only one of which occurred at a bored shaft. During construction of the conventional exploration shaft at the Australian nickel mine, five miners were killed and 63 lost-time accidents occurred. With the drilled shaft, only seven lost-time accidents occurred and there were no fatalities.

4. Bored shafts may offer significant savings in time. Progress for a drill-and-blast shaft may average 200 feet per month under favorable conditions, compared to 100-200 feet per week for shaft drilling which, in many cases, may be under severe conditions.

Waste Isolation Pilot Plant (WIPP)

In addition to providing access for the development of uranium resources, shaft drilling may also play a major role in the disposal of nuclear waste.

The Waste Isolation Pilot Plant (WIPP) is a test long-term storage project for nuclear waste generated by the US national defense program. This underground repository is located near Carlsbad, New Mexico at a depth of 2150 feet within a series of salt beds 3300 feet thick. Construction commenced in 1981.

Access to the storage-level chambers is gained through a 12-foot diameter shaft drilled to 2300 feet. Upon completion of this first shaft, a six-foot diameter ventilation shaft was drilled to a depth of 2200 feet. The drilling fluid was saturated brine, which prevented dissolution of the salt beds being penetrated. Table 3 summarizes some of the features of this project.

Table 3
FEATURES OF WIPP DRILLED SHAFTS

Item	Access Shaft	Ventilation Shaft
Diameter	142 inches	72 inches
Depth	2298 feet	2196 feet
Deviation	1.59 feet	2.25 feet
Drilling time	112 days	45 days
Penetration Rate	1.11 ft/hr	2.57 ft/hr
Total time	215 days	69 days

The access shaft was lined from the surface to a depth of 850 feet with a circular steel liner backfilled with concrete. Below 850 feet, the shaft was within salt beds requiring no lining. The ventilation shaft was unlined in its entirety and was later enlarged conventionally. The total cost of completing these shafts was $7.8 million.

Ironically, construction of the proposed civilian nuclear waste repository at Yucca Mountain on the Nevada Test Site will probably not use shaft drilling for construction of access shafts. In this instance, the Department of Energy considers the ability to continuously view, map, and test all rock formations penetrated to be of more importance than the integrity of rock adjacent to the shaft. Conventional means of shaft sinking permit such access much more readily.

Current Applications

In recent years, many of the world's richest uranium deposits have been discovered in the Athabasca Basin of northern Saskatchewan. Serious consideration is being given to shaft drilling methods as a possible means of developing and exploiting those deposits. They occur in soft, saturated rocks and, because of their high radioactivity, cannot be mined by methods which bring personnel into close contact with the ore.

Shaft drilling offers both ground control and remote operating advantages to a mining system for these

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deposits. In this case, a series of large-diameter holes would be drilled from a development level immediately above the deposit, drilled ore could be pumped to the surface as a slurry, and the voids created could be backfilled with a low-grade concrete. The Cigar Lake and Midwest projects have such systems currently under evaluation.

The excavation cost for the large Australian nickel mine shaft was roughly $160 per ton of material removed from the drill hole. If that cost could be achieved on the Cigar Lake orebody (average grade about 14% U_3O_8), the resulting "mining cost" would be about $0.60 per pound U_3O_8 mined. Even at current U_3O_8 prices in the $15-16 per pound range, an ample margin would likely be available to cover the other costs of exploitation.

As shown below, the method also holds significant promise at the lower grades reported for other undeveloped Saskatchewan orebodies.

Ore Deposit	Ore Grade % U3O8	Shaft Drilling Mining Cost ($/lb U3O8)
Cigar Lake Main Pod	14.4	0.56
Cigar Lake Extension	4.8	1.67
Dawn Lake	1.97	4.06
McClean Lake	1.8	4.44
Midwest	1.25	6.40

By comparison, mining costs at Energy Fuels breccia pipe operations in northern Arizona are estimated at $3-4 per pound U_3O_8. Mining costs for low-grade mines, however, such as those in the Elliot Lake district of Canada are much higher, in the range of $10-15 per pound U_3O_8.

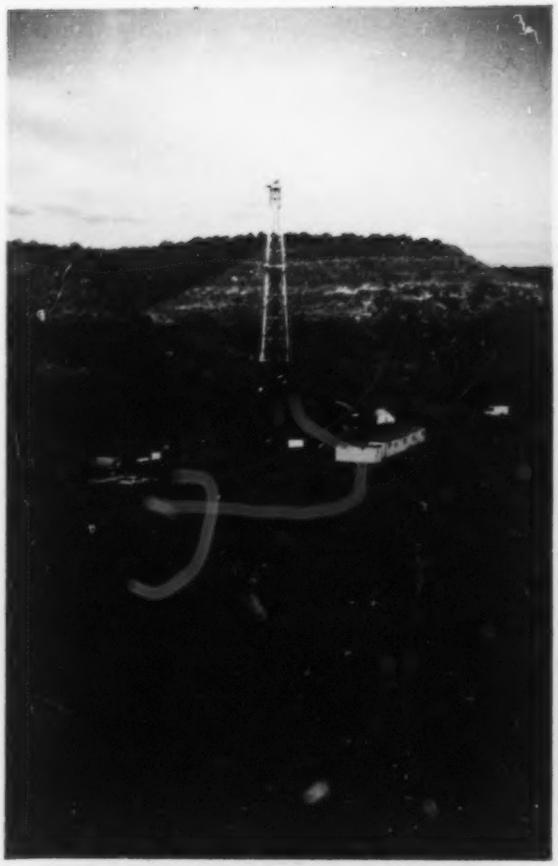

Figure 9. Shaft drilling rig at Energy Fuels' Pigeon mine in northern Arizona. (Photo courtesy of Energy Fuels.)

Summary

In conclusion, shaft drilling may not be the favored method in a majority of cases since costs can be relatively high, particularly when competition among the few companies with shaft drilling capability is weak. In other cases, logistics may be a problem, water may be scarce, or even disposal of the drilling mud may prove difficult. There can be no doubt, however, that shaft drilling offers a very real alternative to conventional methods in circumstances where the combination of water and unstable ground occur.

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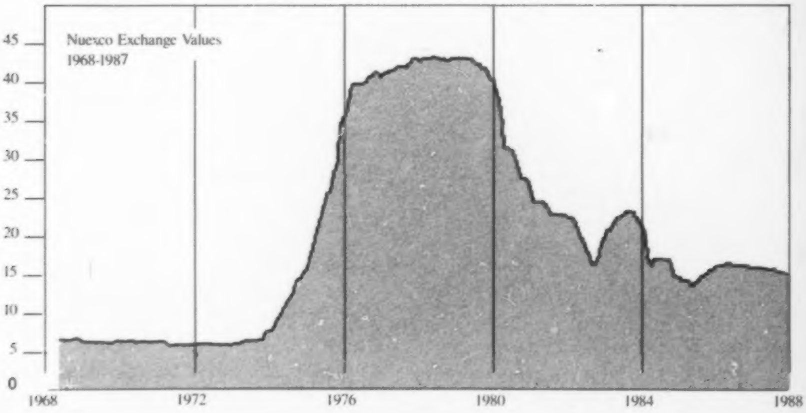
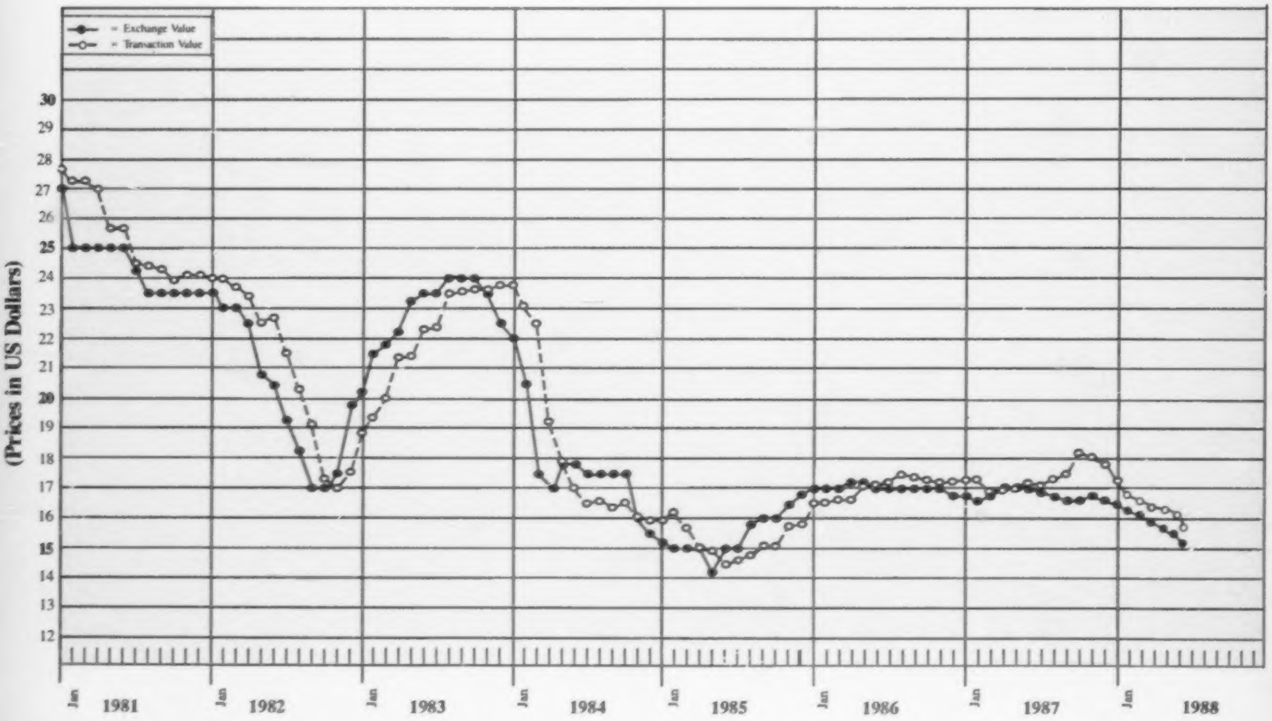
HISTORICAL MARKET DATA





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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	**15.10**						

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	.25	.60	**0.00**						

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	**15.80**						

HISTORICAL MARKET DATA

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF$_6$)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	**1.80**						

HISTORICAL UF$_6$ VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF$_6$)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	**44.00**						

HISTORICAL US UF$_6$ PREMIUM (Relative to the UF$_6$ Value)

Determined as of the last day of the month indicated ($US/kg U as UF$_6$)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	**0.00**						

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay)

Determined as of the last day of the month indicated ($US per SWU)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	**68**						

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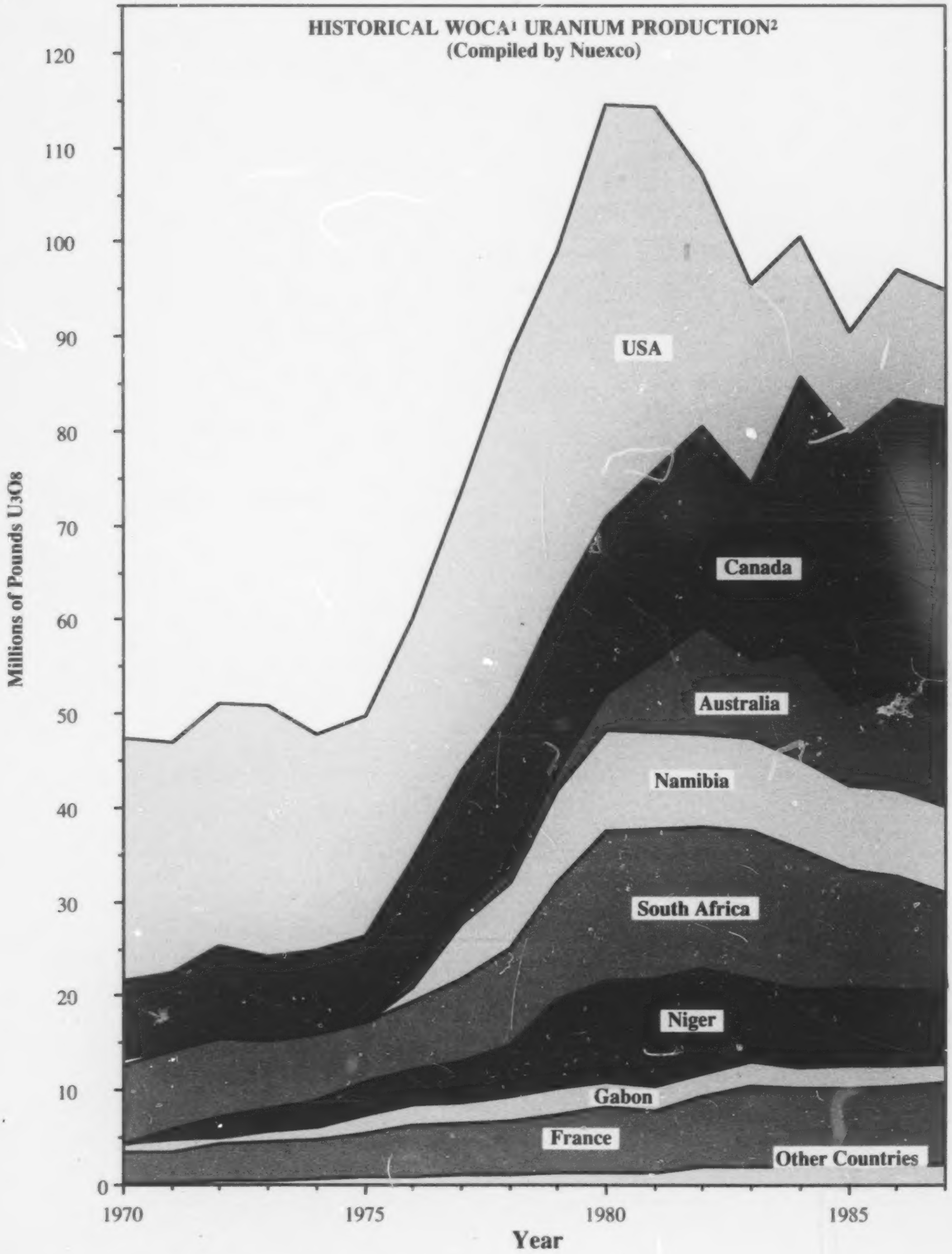

[1] WOCA = World Outside of Centrally-Planned Economic Areas.
[2] 1987 production data are preliminary.

HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26 16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6

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[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Rresources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, ASsistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	202.7
1986	Avg.	155.5	101.5	213.0
1987	Avg.	168.7	108.9	—
Jan	1987	—	106.2	215.9
Feb	1987	—	108.9	216.5
Mar	1987	164.7	108.4	222.2
Apr	1987	—	108.3	222.2
May	1987	—	108.1	222.0
June	1987	167.2	108.1	222.2R
July	1987	—	108.7	222.5R
Aug	1987	—	110.5	222.2R
Sep	1987	170.0	109.3	222.8R
Oct	1987	—	108.6	223.0
Nov	1987	—	110.0	222.6
Dec	1987	172.9	111.9	—
Jan	1988	—	112.4	—
Feb	1988	—	112.3	—
Mar	1988	176.0	112.3	—

P = Preliminary   R = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

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CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.1	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.5	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1	140.4	20.47	17.50	16.50	12.63	13.53
Dec	1987	125.5	140.5	20.62	17.31	16.37	12.54	13.75
Jan	1988	126.4R	140.8	20.70	17.54	16.65	12.82	13.73
Feb	1988	125.8R	141.3	20.94	17.97	17.07	13.01	13.69
Mar	1988	126.1R	142.0	20.55R	17.88R	16.78R	13.10R	13.62R
Apr	1988	126.7R	142.5	21.03	18.21P	16.96P	13.29P	13.62P
May	1988	126.9	143.4	—	—	—	—	—

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975	Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976	Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977	Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978	Avg.	27.14	—	40.3	74.3	658,261	1,502,975
1979	Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	—	—	137.7	246.8	750,256	—
Jan	1987	—	—	128.9	233.9	750,496	529,682
Feb	1987	—	—	130.3	237.0	758,230	600,258
Mar	1987	88.17	197.1	132.4	239.6	763,003	536,033
Apr	1987	—	—	134.1	242.5	765,309	535,876
May	1987	—	—	135.6	243.6	761,026	531,732
Jun	1987	90.74	203.5	136.6	244.9	763,319	571,407
July	1987	—	—	138.2	246.8	764,810	624,954
Aug	1987	—	—	140.2	249.9	761,338	564,387
Sep	1987	100.79	224.7	142.0	252.4	742,417	587,707
Oct	1987	—	—	143.6	255.5	725,599	599,116
Nov	1987	—	—	144.8	256.3R	734,630	616,725
Dec	1987	100.34	267.0	145.9	258.3	712,896	613,262
Jan	1988	—	—	147.2	261.5	711,983	615,889
Feb	1988	—	—	148.2	265.7	730,313	619,159
Mar	1988	102.96	232.4	150.2	268.4	—	—
Apr	1988	—	—	151.9	272.7	—	—
May	1988	—	—	153.1	—	—	—

P = Preliminary R = Revised since last month

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[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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UNITED STATES

		Producer Price Index[1]				Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	Consumer Price Index[2] (1982-1984 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	111.2	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	114.1	13.20	13.49	11.98	9.65
1987	Avg.	102.6	102.8	113.6	—	—	—	—	—
Jan	1987	100.4	100.5	111.2	—	12.94	12.98	12.18	9.84
Feb	1987	100.8	101.0	111.6	—	12.99	12.83	12.21	9.84
Mar	1987	101.1	101.2	112.1	116.1	13.04	12.79	12.24	9.84
Apr	1987	101.6	101.9	112.7	—	13.16	12.90	12.30	9.82
May	1987	101.9	102.6	113.1	—	12.97	12.92	12.31	9.83
Jun	1987	102.4	103.0	113.5	117.2	13.05	12.93	12.27	9.84
Jul	1987	103.1	103.5	113.8	—	13.06	13.07	12.37	9.89
Aug	1987	103.7	103.8	114.4	—	13.03	13.07	12.34	9.90
Sep	1987	103.5	103.7	115.0	117.8	13.19	13.44	12.56	9.98
Oct	1987	104.0	104.1	115.3	—	12.96	13.06	12.52	9.95
Nov	1987	104.2	104.2	115.4	—	12.89	13.10	12.56	10.00
Dec	1987	104.1	104.1	115.4	118.7	12.78	13.14	12.62	10.05
Jan	1988	104.3	104.5	115.7	—	13.02	13.00	12.56	10.03
Feb	1988	104.4	104.6	116.0	—	13.13	12.93	12.55	10.04
Mar	1988	104.7	104.9	116.5	119.4	13.14	13.15	12.55	10.05
Apr	1988	105.6	105.8	117.1	—	—	—	12.52	10.10
May	1988	106.1	106.5	117.5	—	—	—	—	—

P = Preliminary R = Revised since last month

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[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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NUEXCO REPORT 239 FIGURES OF THE MONTH (June 30, 1988)	This Month (Report 239)	Last Month (Report 238)	12 Months Ago (Report 227)
Exchange Value ($US per pound U_3O_8)	15.10	15.40	16.90
US Premium for the Exchange Value ($US per pound U_3O_8)	0	0.60	.60
UF_6 Value ($US per kg U as UF_6)	44.00	44.75	47.75
US Premium for the UF_6 Value ($US per kg U as UF_6)	0	1.00	1.75
Transaction Value ($US per pound U_3O_8 equivalent)	15.80	16.10	17.10
Loan Rate (Per Annum)	3.5%	3.5%	3%
Conversion Value ($US per pound U as UF_6)	1.80	1.80	1.80
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	7.2	7.0	3.7
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	1.3	.9	1.0
Near-Term Supply-Demand Ratio	5.5	7.8	3.7
Recent Uranium Sales:[3]			
Number of Transactions	8	6	12
Quantity of Material (Millions of pounds U_3O_8 equivalent)	8.4	1.5	3.9
Nuexco SWU Value: ($US per SWU):			
at 0.3 tails assay	68	68	73
US DOE SWU Prices: ($US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6[8]: ($US per kg U as UF_6)			
2.5 w/o U_{235}	405	409	441
3.0 w/o U_{235}	518	523	563
3.5 w/o U_{235}	633	639	691
4.0 w/o U_{235}	750	757	818

---

[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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EXECUTIVE SUMMARY
REPORT 239
(All data as of June 30, 1988)

Exchange Value **\$15.10, down \$0.30**	The **Exchange Value** is **\$15.10** per pound U_3O_8, down \$0.30 since last month. The US Premium (relative to the Exchange Value) is \$0.00, down \$0.60 since last month.
UF_6 Value **\$44.00 down \$0.75**	The **UF_6 Value** is **\$44.00** per kg U as UF_6, down \$0.75 since last month. The US Premium (relative to the UF_6 Value) is \$0.00, down \$1.00 since last month.
Transactions	**Eight** recent natural uranium sales are reported, involving approximately **8.4 million** pounds equivalent U_3O_8. Four of these sales involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **7.2 million** pounds U_3O_8 equivalent, up 300,000 pounds since last month. Active spot and near-term **uranium demand** totals **1.3 million** pounds, up 400,000 pounds since last month. The spot and near-term **supply-demand ratio** fell to **5.5 to 1**.
Transaction Value **\$15.80 down \$0.30**	The **Transaction Value** is **\$15.80** per pound U_3O_8, **down \$0.30** since last month. The calculation includes 15 transactions involving a total of more than 2.4 million pounds U_3O_8 and equivalent UF_6 and covers a period of 4 months.
Loan Rate **3.5%, unchanged**	The **Loan Rate** is **3.5 percent** per annum, unchanged. No loan transactions are reported.
Conversion Value **\$1.80, unchanged**	The **Conversion Value** is **\$1.80** per pound U as UF_6, unchanged since last month. One secondary market transaction for conversion services took place this month. Active demand totals 1.05 million pounds U as UF_6.
SWU Value \$68, unchanged	The **SWU Value** at .3% tails assay is **\$68** per SWU, unchanged since last month. Four secondary market SWU transactions are reported this month, involving more than 300,000 SWU.

* * *

Australia	The Australian Labor Party passed two uranium-related resolutions at its Biennial conference, one of which will establish a committee to review its national uranium policies.
United States	California voters narrowly passed a resolution extending the life of the Ranch Seco nuclear power plant for an additional eighteen months. An unprecedented agreement has been reached in Pacific Gas & Electric Company's Diablo Canyon rate case. The US Supreme Court issued its decision on the US Producers vs. DOE lawsuit, which is significantly affecting the US premium for U_3O_8.
Analysis and Commentary	Nuexco's updated World Uranium Consumption Forecast for 1988-2000 shows a slight increase over the previous year's forecast.
Raw Materials	Technological developments in mining techniques such as *shaft drilling may lead to lower* production costs.

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Monthly Report

August 1988 Number 240

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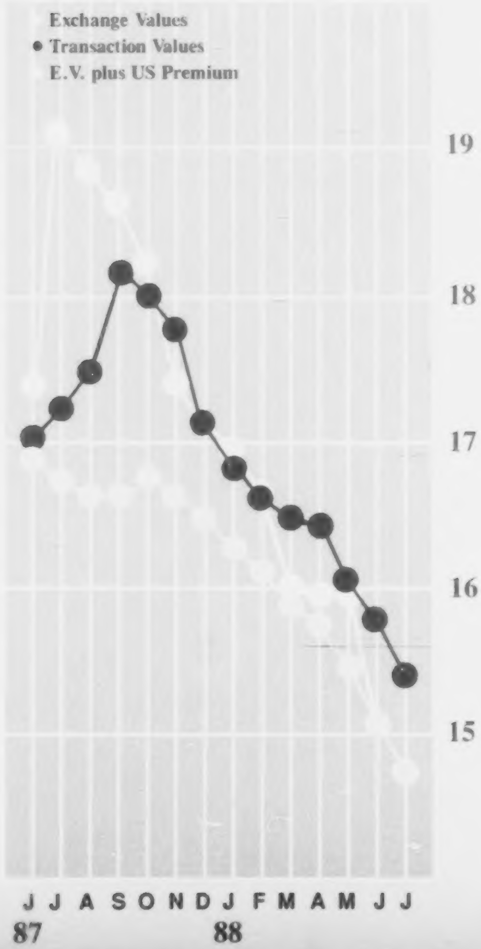

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

August 1988 No. 240

R. GENE CLARK, ***EDITOR*** **FRANCE A. HEAD**, ***ASSOCIATE EDITOR***

PRICING

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MARKET VALUES SUMMARY

July 31, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE[1]	$14.75/lb U_3O_8	7,915[2]	1,695[2]
US Premium[7]	- 0 -		
UF₆ VALUE[2]	$42.75/kg U as UF_6	7,915[2]	1,695[2]
US Premium	- 0 -		
CONVERSION VALUE[3]	$1.85/lb U as UF_6	0	1,365
SWU VALUE[4]			
0.3 tails assay:	$68/SWU	720	10
LOAN RATE[5]	3.5%/annum	5,600	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE[6]	15.45	2.4	15	3

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

[2] For either uranium concentrates or uranium hexafluoride.

DEFINITIONS

1. **The Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. **The UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. **The Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. **The SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. **The Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. **The Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. **The US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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PRICING

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of July 31, 1988)

July was an active month with ten transactions concluded, involving more than five million pounds U_3O_8 equivalent. Seven transactions were for short-term delivery, and six transactions occurred directly between producers and utilities. The secondary conversion market showed increased activity, and two transactions are near conclusion. The SWU market was quiet, with no transactions reported.

The **Exchange Value** fell to **$14.75** per pound U_3O_8, a $0.35 decrease from last month, as some producers released material for sale that was previously held in expectation of greater demand for US-origin material. Additional low-priced material is also being made available in Europe as a spin-off component of more complex transactions. The seven short-term U_3O_8 sales reported this month occurred at or near the Exchange Value. Six transactions were concluded directly between producers and utilities.

In addition, three discretionary buyers are currently evaluating bids at prices close to the Exchange Value. Because of the bidding terms specified by one of these buyers, approximately 660 thousand pounds of material must be considered off the market, pending completion of that transaction.

* * *

The **US Premium** for U_3O_8 is **zero** for the second consecutive month, and there is currently little demand for US-origin only material. Since the Supreme Court decision, sellers of US-origin U_3O_8 have generally been willing to sell in the mainstream market. In addition, some utilities are consuming US-origin inventories that had been established and were being held in anticipation of potential non-US uranium usage restrictions.

Nevertheless, the uranium market remains unsteady because of pending legislative, judicial and political factors. On July 14, the Senate Finance Committee and the House Ways and Means Committee voted against inclusion of a uranium package in the US/Canada Free Trade Agreement (FTA) implementing legislation. The comprehensive uranium package, in the form of separate legislation, fared no better at a July 28 Senate subcommittee hearing chaired by Representative Philip Sharp (D-Indiana) where its review was unenthusiastic. The full House Ways and Means Committee is scheduled to review the legislation on August 10, but it appears unlikely that Congress will have time to consider it before adjourning on October 3.

Attention has now shifted to Canada, in response to the recent decision of the Canadian Senate to delay consideration of the FTA by blocking its approval until a national election is held. Although this action could ultimately kill the FTA, many industry participants view the Senate's obstinacy as a temporary roadblock, particularly if support for the agreement in the USA persists. The FTA goes before the Canadian Senate on August 10, while its implementing legislation is now before seven Senate committees and eight House committees in the USA. Congress has promised to act on the FTA before October 3.

On July 27, the House Ways and Means Committee conducted a favorable markup of the South African sanctions bill (H.R. 1580) that would eliminate the legal loophole currently allowing imports of South African UF_6 to the USA. It is unclear whether the bill will get to a House vote. The Senate version of the South African bill (S.2378) is expected to be marked up by the Senate Foreign Relations Committee in August, unless the Senate adopts the House bill, which was recommended by the Chairman of the Senate Foreign Relations Committee, Senator Claiborne Pell (D-Rhode Island). If adopted, the bill will be able to avoid the usual committee hearings and markups and go directly to the Senate floor for a full vote. There continues to be formidable opposition to the bill in the Senate, particularly from Senator Jesse Helms (R-North Carolina).

* * *

Active supply of natural uranium (concentrates and UF_6) for spot delivery totals **7.9 million pounds** U_3O_8 equivalent, an increase of almost 700 thousand pounds since last month. **Active demand** for natural uranium also advanced to **1.7 million** pounds. The near-term **supply-demand ratio** is **4.6:1**, compared to last month's ratio of 5.5:1. Most of the uranium supply and demand is for U_3O_8 rather than UF_6.

* * *

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The **Transaction Value** fell to **$15.45** per pound U_3O_8, a $0.35 decrease from last month. The calculation extends over a three-month period and includes 15 transactions involving approximately 2.4 million pounds U_3O_8 equivalent.

* * *

The **UF_6 Value** dropped to **$42.75** per kilogram U as UF_6, a $1.25 reduction since last month. Three UF_6 transactions, involving more than 700 thousand pounds U_3O_8 equivalent were concluded. Unusually strong demand during July was met by an abundance of low-priced supply, as each of the UF_6 transactions reported were concluded at prices below that of the previous transaction. While there is little additional near-term demand, supply remains strong. A significant amount of the available UF_6 is unacceptable to the majority of buyers due to origin concerns. As a result, these suppliers must offer it at particularly favorable prices or terms. Other UF_6 sellers have indicated a willingness to sell large quantities at prices at or near the UF_6 Value. The liberation of additional natural UF_6 as a result of enriched uranium product (EUP) transactions is expected to provide further downward pressure on prices.

* * *

The **US Premium** for **UF_6** is unchanged at **zero**. No buyers are currently specifying US-origin only UF_6, and sellers of US-origin material are willing to sell at prices competitive with material of other origins.

* * *

The **Loan Rate** remains at 3.5 percent per annum, with one loan transaction occurring at the current Loan Rate.

The **Conversion Value** increased by $0.05 to **$1.85 per pound** U in response to firmer demand in the secondary market. No conversion transactions were finalized this month, but several buyers are evaluating offers at prices near the Conversion Value. In addition, two other buyers have expressed interest in purchasing conversion services within the next six months. Because conversion services generally occur as an adjunct to other nuclear fuel transactions, conversion price terms tend to vary widely and are rarely equal to the difference between the UF_6 price and the U_3O_8 price.

ENRICHMENT SERVICES AND SWU

The **SWU Value** remained at **$68 per SWU** during a quiet month for the enrichment sector of the market. No SWU transactions are reported, although one US utility was assessing competitive offers during July for Western-origin SWUs for 1990 delivery, and is expected to make a decision in August. A few European enrichment buyers are expected to enter the market over the next several weeks, but they will be purchasing relatively small quantities.

While a few US utilities have begun to evaluate options for a portion of their 1991-1995 requirements, the utilities which did not extend their DOE commitments past 1995 still appear uninterested in contracting for that period at this early date. Those with 30 percent of requirements open from 1991-95, however, should comprise the bulk of secondary market demand for the remainder of 1988.

DOE SWUs are still available on the secondary market, with the most recent transaction reported last month. The Soviet and Chinese enrichment suppliers continue to make competitive offers, particularly in view of gaining a market share in North America, although neither seller has succeeded in arousing much buyer interest in that region.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (July 31, 1988)	Last Month (June 30, 1988)	12 Months Ago (July 31, 1987)	This Month (July 31, 1988)	Last Month (June 30, 1988)	12 Months Ago (July 31, 1987)
Australia (dollar)	18.35	19.22	23.99	47.70	49.96	62.36
Belgium (comm. franc)	574.60	575.68	642.75	1,494	1,497	1,671
Canada (dollar)	17.82	18.34	22.32	46.34	47.69	58.01
EEC (ecu)	13.11	13.26	14.99	34.09	34.46	38.97
Finland (markka)	64.98	65.40	75.38	168.93	170.02	195.98
France (franc)	92.65	92.75	103.27	240.87	241.13	268.47
FRG (mark)	27.49	27.51	31.06	71.48	71.53	80.75
Italy (lira)	20,311	20,416	22,477	52,805	53,078	58,436
Japan (yen)	1,953	2,007	2,503	5,076	5,218	6,506
Netherlands (guilder)	31.05	31.05	34.98	80.71	80.72	90.93
South Africa (rand)	35.96	35.11	34.72	93.48	91.27	90.25
Spain (peseta)	1,812	1,827	2,117	4,710	4,749	5,505
Sweden (krona)	94.13	94.55	108.27	244.71	245.81	281.49
Switzerland (franc)	22.86	22.80	25.74	59.43	59.28	66.91
UK (pound)	8.56	8.81	10.50	22.26	22.90	27.30
US (dollar)	14.75	15.10	16.75	38.35	39.26	43.55

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	This Month (July 31, 1988)	Last Month (June 30, 1988)	12 Months Ago (July 31, 1987)	This Month (July 31, 1988)	Last Month (June 30, 1988)	12 Months Ago (July 31, 1987)
Australia (dollar)	19.22	20.11	24.77	49.96	52.27	64.41
Belgium (comm. franc)	601.87	602.36	663.85	1,565	1,566	1,726
Canada (dollar)	18.67	19.19	23.05	48.54	49.90	59.92
EEC (ecu)	13.73	13.87	15.48	35.71	36.06	40.25
Finland (markka)	68.06	68.43	77.86	176.94	177.90	202.41
France (franc)	97.05	97.05	106.66	252.30	252.31	277.29
FRG (mark)	28.80	28.79	32.08	74.87	74.85	83.40
Italy (lira)	21,275	21,363	23,215	55,311	55,539	60,354
Japan (yen)	2,045	2,100	2,585	5,317	5,459	6,720
Netherlands (guilder)	32.52	32.49	36.12	84.54	84.47	93.92
South Africa (rand)	37.66	36.74	35.85	97.92	95.50	93.21
Spain (peseta)	1,898	1,911	2,187	4,933	4,969	5,685
Sweden (krona)	98.60	98.94	111.83	256.33	257.21	290.73
Switzerland (franc)	23.95	23.86	26.58	62.25	62.03	69.11
UK (pound)	8.97	9.22	10.85	23.31	23.97	28.20
US (dollar)	15.45	15.80	17.30	40.17	41.08	44.98

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb U as UF₆ This Month (July 31, 1988)	per lb U as UF₆ Last Month (June 30, 1988)	per lb U as UF₆ 12 Months Ago (July 31, 1987)	per kg U as UF₆ This Month (July 31, 1988)	per kg U as UF₆ Last Month (June 30, 1988)	per kg U as UF₆ 12 Months Ago (July 31, 1987)
Australia (dollar)	2.30	2.29	2.72	5.07	5.05	6.00
Belgium (comm. franc)	72.07	68.62	72.91	158.88	151.29	160.74
Canada (dollar)	2.24	2.19	2.53	4.93	4.82	5.58
EEC (ecu)	1.64	1.58	1.70	3.63	3.48	3.75
Finland (markka)	8.15	7.80	8.55	17.97	17.19	18.85
France (franc)	11.62	11.06	11.71	25.62	24.38	25.82
FRG (mark)	3.45	3.28	3.52	7.60	7.23	7.77
Italy (lira)	2,548	2,434	2,550	5,616	5,365	5,621
Japan (yen)	244.90	239.23	283.88	539.92	527.42	625.84
Netherlands (guilder)	3.89	3.70	3.97	8.58	8.16	8.75
South Africa (rand)	4.51	4.19	3.94	9.94	9.23	8.68
Spain (peseta)	227.22	217.73	240.17	500.93	480.02	529.49
Sweden (krona)	11.81	11.27	12.28	26.03	24.85	27.08
Switzerland (franc)	2.87	2.72	2.92	6.32	5.99	6.44
UK (pound)	1.07	1.05	1.19	2.37	2.32	2.63
US (dollar)	1.85	1.80	1.90	4.08	3.97	4.19

SWU VALUE AND UF₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	SWU Value at 0.30% Tails Assay This Month (July 31, 1988)	SWU Value at 0.30% Tails Assay Last Month (June 30, 1988)	UF₆ Value per kg U as UF₆ This Month (July 31, 1988)	UF₆ Value per kg U as UF₆ Last Month (June 30, 1988)
Australia (dollar)	84.59	86.54	53.17	55.99
Belgium (comm. franc)	2,649	2,592	1,665	1,677
Canada (dollar)	82.18	82.60	51.66	53.44
EEC (ecu)	60.45	59.69	38.00	38.62
Finland (markka)	299.56	294.50	188.32	190.55
France (franc)	427.14	417.69	268.53	[illegible]
FRG (mark)	126.75	123.91	79.68	[illegible]
Italy (lira)	93,638	91,942	58,868	[illegible]
Japan (yen)	9,002	9,038	5,659	[illegible]
Netherlands (guilder)	143.13	139.83	89.98	[illegible]
South Africa (rand)	165.77	158.10	104.21	102.30
Spain (peseta)	8,352	8,225	5,251	5,322
Sweden (krona)	433.95	425.80	272.81	275.51
Switzerland (franc)	105.39	102.69	66.25	66.44
UK (pound)	39.47	39.67	24.81	25.67
US (dollar)	68.00	68.00	42.75	44.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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RECENT TRANSACTIONS[1]

URANIUM SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4334	1988	50-100	98-102	Producer	Utility	US Origin
4336	1988	50-100	98-102	Producer	Utility	US Origin
4337	1989	101-300	103-107	Producer	Utility	UF_6
4339	1991-97	1,001-1,500	R[3]	Producer	Utility	US Origin, Base Price Escalated
4340	1991-97	1,001-1,500	93-97	Producer	Utility	Market-Related Pricing
4341	1989	101-300	98-102	R[3]	Utility	UF_6
4342	1988	50-100	98-102	Intermediary	Utility	US-Origin UF_6
4344	1989-98	1,501-3,000	R[3]	Producer	Utility	
4345	1988	less than 50	98-102	Producer	Utility	
4346	1988	50-100	98-102	Producer	Utility	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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CONVERSION SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks

No secondary market conversion sales are reported this month.

ENRICHMENT SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks

No secondary market enrichment sales are reported this month..

LOAN TRANSACTIONS

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Loan Rate	Lender	Borrower	Remarks
4335	1988	less than 50	98-102	Intermediary	Producer	US Origin

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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CURRENT MARKET DATA

URANIUM SUPPLY
(July 31, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
87-1002	270	—	
87-1023	500	500 per year	1988-90
87-1061	1,000	700 per year	1988-91
87-1123	1,000	1,000 per year	
87-1141	500	200 per year	1989-92
87-1161	1,000	1,000 per year	UF_6
88-1000A	350	—	1988
88-1000B*	100	—	1988, UF_6
88-1001	200	200 per year	1988-91
88-1026	250	—	1988
88-1036	100	—	1988
88-1041*	680	—	1988, UF_6
88-1064	400	400 per year	1988-90
88-1078	1,200	—	1988
88-1122*	365	—	1988, UF_6
87-1001	—	500 per year	1989 on
87-1005	—	250 per year	1988-95
88-1096A	—	290	1990, UF_{6e}
Total	7,915		
INACTIVE			
87-1019	1,000	1,000 per year	1988-91
87-1053	100	500 per year	1989 on
87-1159	60	—	
88-1033A*	130	—	1988, UF_{6e}
88-1086*	75	—	1988
88-1120*	100	—	1988
87-1130	—	580	1989
Total:	**1,465**		

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: None

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URANIUM DEMAND
(July 31, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
88-1083*[3]	660	—	1988
88-1094	35	—	1988
88-1103*	250	—	1988
88-1106*	450	—	1988, UF_6
88-1115*	300	—	1988
87-1134	—	260	1989
87-1172	—	500 per year	1990 on
88-1062	—	200 per year	1990-on
88-1089	—	1,200 per year	1990-95
88-1107A*	—	100	1989, UF_{6e}
Total:	1,695		
INACTIVE			
87-1154A	80	—	1988, UF_{6e}
88-1035A*	40	—	1988, UF_{6e}
88-1084*	500	—	1988
88-1126*	1,400	—	1988
87-1163	—	160	1989-93
Total	**2,020**		

* New or revised since last month.
[1] Measured from the date of this Report.
[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
[3] Transaction pending.
Projects removed since last month: 88-1014, 88-1044, 88-1056, 88-1060, 88-1069, 88-1100, 88-1102.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(July 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1012	1,000	—	
87-1157	4,000	—	
88-1057	600	—	
Total:	**5,600**		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
Total:	**2,000**		

Available to Borrow:

No inquiries to borrow are reported.

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* New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None

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CONVERSION SUPPLY AND DEMAND

(July 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale **ACTIVE**			
No active conversion supply is reported this month.			
INACTIVE			
87-1008	770	475	1988
Total:	**770**		
Inquiries to Purchase **ACTIVE**			
88-1034*	150	600	1989-90
88-1059*[2]	165	—	1988
88-1098[2]	300	—	1989
88-1113*	660	—	1989
88-1127*	90	—	1988
Total:	**1,365**		
INACTIVE			
88-1021	65	—	
Total:	**65**		

* New or revised since last month.

[1] Measured from the date of this Report.

[2] Transaction pending.

Projects removed since last month: None.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND

(July 31, 1988)

	Delivery Period[1] (Thousands of SWU)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
87-1058*	20	—	
88-1065*	500[3]	500	1990, UF$_6$e
87-1068	200	—	UF$_6$e
88-1096B		55	1990, UF$_6$e
Total	**720**		
INACTIVE			
87-1004	55	—	
87-1128	360	—	
88-1033B*	15	—	UF$_6$e
88-1082	25	—	
Total:	**455**		
Inquiries to Purchase			
ACTIVE			
88-1085	10	—	
88-1077	—	70	1989-91
88-1107B*	—	60	1989, UF$_6$e
Total:	**10**		
INACTIVE			
87-1154B	20	—	UF$_6$e
88-1035B*	20	—	UF$_6$e
Total:	**40**		

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* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

[3] SWU supply now estimated to fall within the near-term time frame.

Projects removed since last month: None

UPDATE ON US NUCLEAR POWER PLANT BACKLOG

Introduction

The backlog of US nuclear reactors continues to diminish and, as of July 1988, only seventeen units remain, compared to 36 at January 1986 (see NUEXCO Report No. 211). Of these seventeen units, five are essentially completed and twelve are under construction (six of which have been deferred indefinitely). NUEXCO considers a unit to enter the backlog when construction starts and to exit when commercial operation begins.

Table 1 shows the current status of the seventeen reactors, which have a total electric generating capacity of 19,730 MWe, as well as two other reactors which are on order. Philadelphia Electric's (PECO) Limerick 2 achieved the most progress during the two-and-a-half-year period, and is now 91-percent complete, compared to 31-percent in January 1986. In contrast, completion percentages for Comanche Peak 1 and Perry 2 have both decreased since our last report. Nine of the units currently in the backlog are at least 90-percent completed. Tables 2 and 3 present completion percentage data on the backlogged reactors.

Table 2
COMPLETION PERCENTAGES
OF UNITS IN US BACKLOG

Percent Complete[1]	Number of Units[2]
90-100	9
80-89	3
70-79	1
60-69	1
50-59	1
40-49	1
30-39	1
20-29	-
10-19	-
0-9	-
TOTAL	**17**

[1] As listed in Table 1.

[2] Excludes units on order.

Units Entering Commercial Operation since 1986

Since our last report, fifteen units have entered commercial operation, six of which came on line in 1986: Palo Verde 2, Diablo Canyon 2, Millstone 3, River Bend 1, Catawba 2, and Hope Creek 1.

During 1987, six units were declared to be commercially operating: Shearon Harris 1 (North Carolina), Byron 2 and Clinton 1 (Illinois), Vogtle 1 (Georgia), Perry 1 (Ohio), and Beaver Valley 2 (Pennsylvania).

Fermi 2, Nine Mile Point 2 and Palo Verde 3 (a total of 3,450 MWe) went into commercial operation during the first half of 1988, and South Texas 1 and Braidwood 2 received full-power licenses. South Texas 1 and Braidwood 2 are expected to enter commercial operation in late August 1988.

Nuclear Reactors in the Backlog and On Order

Comanche Peak 1 and 2

Texas Utilities Electric Company (TUEC), the 94-percent owner of Comanche Peak 1 and 2, deferred the expected commercial operation dates of these two 1,150-MWe units which are undergoing extensive re-inspection and rework for design and documentation deficiencies. Comanche Peak 1, however, is essentially complete, and TUEC now plans fuel loading in June 1989 and first commercial operation about six months later.

Unit 2, which is approximately 86-percent complete, is also being reinspected for the same faults as its twin unit and is not expected to operate until late 1991. The two-unit plant, which has an estimated cost of $9.07 billion, has been under construction for sixteen years.

An encouraging sign for Comanche Peak's future is the recent agreement reached by TUEC and the remaining intervenor, Citizens Association for Sound Energy (CASE), to drop all pending contentions concerning quality assurance and control that have held up the licensing process. The agreement, which received NRC approval, eliminates further public hearings. In exchange, the President of CASE, or her designee, will serve at least five years on the Operating Review Committee which directly oversees plant construction. In the event of a

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Table 1
STATUS OF US NUCLEAR REACTOR BACKLOG

	Lead Utility	Type	MWe	Percent Complete 1/86	Percent Complete 7/88	Commercial Operation Date (Estimated)
Essentially Completed Units						
Braidwood 1	Commonwealth Edison	PWR	1107	59	100	August 88
Seabrook	Public Service Company of New Hampshire	PWR	1150	95	100	Indefinite
Shoreham	Long Island Lighting Co.	BWR	804	99	100	Indefinite
South Texas 1	Houston Power & Light	PWR	1239	83	100	August 88
Watts Bar 1	Tennessee Valley Authority	PWR	1177	99	100	December 90
Units Under Construction						
Comanche Peak 1	Texas Utilities Electric Co.	PWR	1150	99	94	December 89
Comanche Peak 2	Texas Utilities Electric Co.	PWR	1150	78	86	December 91
Limerick 2	Philadelphia Electric Co.	BWR	1055	31	91	December 90
South Texas 2	Houston Power & Light	PWR	1250	65	98	June 89
Vogtle 2	Georgia Power Co.	PWR	1100	53	86	June 89
Watts Bar 2	Tennessee Valley Authority	PWR	1177	85	99	Indefinite
Deferred:						
Bellefonte 1	Tennessee Valley Authority	PWR	1213	83	89	Indefinite
Bellefonte 2	Tennessee Valley Authority	PWR	1213	54	58	Indefinite
Grand Gulf 2	Mississippi Power & Light	BWR	1250	33	33	Indefinite
Perry 2	Cleveland Electric	BWR	1205	57	45	Indefinite
WNP 3	Washington Public Power Supply System	PWR	1240	75	75	Indefinite
WNP 1	Washington Public Power Supply System	PWR	1250	63	63	Indefinite
Units on Order						
Carroll County 1	Commonwealth Edison	PWR	1120	0	0	Indefinite
Carroll County 2	Commonwealth Edison	PWR	1120	0	0	Indefinite

Sources: Energy Information Administration, "Nuclear Power Plant Construction Activity 1987"; U.S. Council for Energy Awareness, "Reactor Information Report (May 23, 1988)"; utility data.

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dispute between CASE and TUEC on technical issues, the NRC will act as arbitrator. This is an unprecedented arrangement, as private citizens opposing nuclear power have never before had direct participation in a nuclear plant's construction program.

South Texas 1 and 2

Houston Lighting & Power Company's (HL&P) South Texas 1 received a full-power license from the Nuclear Regulatory Commission (NRC) in March 1988 and is now testing at 90-percent power. This unit is expected to be in commercial operation in August.

Approximately 98-percent completed, HL&P's South Texas 2, a 1,250-MWe Pressurized Water Reactor (PWR) located near Palacios, Texas, is currently undergoing hot functional testing. The unit should load fuel this December and is slated to go into operation in July 1989. In the fall, the Public Utility Commission (PUC) is expected to begin prudency hearings on both units. Construction was halted on Units 1 and 2 in 1980 after NRC reported deficiencies in the quality assurance and quality control program. In 1982, construction resumed. The cost of both units upon completion is projected to be $5.3 billion ($2,020 per kilowatt installed).

Vogtle 2

Georgia Power's Vogtle 2, the 1,100-MWe sister unit PWR of Vogtle 1 (in commercial operation since June 1987) is 86-percent complete as of June 1 and expected to begin fuel loading in March 1989, ahead of schedule. Commercial operation is anticipated to commence in June 1989. Georgia Power planned four Vogtle units in 1971, although two were cancelled in the mid-70s. Estimated construction cost of the two-unit Vogtle plant is $8.87 billion.

Limerick 2

Construction at Philadelphia Electric's (PECO) Limerick 2 is both on schedule and within budget. The 1,055-MWe Boiling Water Reactor (BWR) is approximately 91-percent complete and scheduled for fuel load in the spring of 1990 (although it could possibly be ready by late 1989). Limerick 2 was about 30-percent complete when PECO halted construction on the unit. Construction resumed about three years later, after Unit 1 went into commercial operation in February 1986. At that time, PECO set a $3.2 billion construction cost cap on Unit 2 and placed the project under a "BUILT-RITE" program, which stipulated that labor contracts could not be renegotiated during the remainder of the construction period and also contained a "no-strike" clause. According to a PECO official, the BUILT-RITE agreements have been instrumental in keeping the project under budget and ahead of schedule.

Bellefonte 1 and 2

The Tennessee Valley Authority (TVA) recently announced that its two Bellefonte units (1,213-MWe PWRs) would be indefinitely deferred as part of a massive cost-cutting measure. In order to remain competitive with private, neighboring utilities, TVA plans to slow its nuclear construction program to avoid a rate hike in 1989. TVA officials project long-term demand growth for electricity at about two percent per year and, since TVA already has surplus power, they believe the additional capacity from Bellefonte will not be needed before the twenty-first century. TVA has cancelled eight of the seventeen reactors first planned in an ambitious nuclear program in the 1970's. The Bellefonte project is currently about 75-percent complete.

Watts Bar 1 and 2

TVA elected to sacrifice, at least temporarily, the Bellefonte plant, but will move ahead with the Watts Bar twin units, although at a slower pace then previously forecast. Despite the difficulties TVA encountered with the NRC over safety and design of the two 1,177-MWe PWRs, the utility opted to complete Watts Bar rather than Bellefonte since it was further along in construction. Watts Bar 1 is essentially completed and scheduled for startup in December 1990. The operation date for Unit 2, which is approximately 99-percent finished, has been deferred indefinitely.

WNP 1 and 3

The Washington Public Power Supply System has no change in plans for the WNP-1 and WNP-3 reactors, which have been on hold since the early 1980s. WNP-1, a 1,250-MWe PWR, had construction halted when 63-percent complete, and is now under consideration for conversion to a Department of Energy (DOE) weapons production facility. No decision is expected to be made

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Table 3
CONSTRUCTION PROGRESS ON US BACKLOG
Between January 1986 and July 1988
(Measured by Changes in Completion Percentages)

Change in Completion Percentage	Number of Units[1]
60-69	1
50-59	-
40-49	1
30-39	2
20-29	-
10-19	2
0-9	9
Negative	2
TOTAL	17

[1] Excludes Carroll County Units 1 and 2 which are on order.

this year on the proposal which, according to press reports, is not DOE's first choice.

WNP-3 construction was halted at 75-percent completion, and will not be restarted until substantial growth in regional power demand occurs.

Perry 2

Centerior Energy's Perry 2 has been deferred indefinitely since July 1, 1985, at 45-percent completion. Perry 1 entered service in November 1987, but its twin 1,205-MWe Unit 2's deferral was largely the result of flat rates in electricity demand growth. In addition, there are ownership issues among the four utilities that may need to be resolved prior to resuming work at the plant.

Grand Gulf 2

There has been no status change in Mississippi Power & Light's (MP&L) 33-percent completed, Grand Gulf Unit 2. Due to problems with regulatory agencies in three states over cost recovery for Grand Gulf Unit 1, MP&L is unlikely to give the go-ahead to Unit 2 in the near future.

Shoreham

Long Island Lighting Company's (LILCO) Shoreham plant was tentatively sold to an agency of the State of New York in June for $1 and will be decommissioned if the sale is consummated. The sale faces numerous obstacles, however, which still must be overcome. The New York legislature, for example, has postponed a vote on the issue in light of forthcoming elections, and New York Governor Mario Cuomo has threatened to order the State legislature into a special session in November if the vote is delayed further. In addition, the New York Public Service Commission and the NRC still must approve the agreement.

Shoreham has been operating under a low-power license but has not been granted full licensing approval due to local opposition to its required emergency planning and evacuation drill. Opponents allege that Long Island, the site of Shoreham, could never be effectively evacuated in the event of a nuclear accident.

Nonetheless, LILCO is forging ahead to obtain licensing approval for Shoreham and completed an emergency exercise in early June. According to a Federal Emergency Management Agency (FEMA) spokesman, FEMA is currently reviewing on-site and off-site capabilities and will present its findings to the NRC in mid-September. Sometime thereafter, the NRC will make a final decision on full licensing of the plant.

Seabrook

Plagued by similar political opposition to emergency planning drills as Shoreham, licensing of Seabrook remains at a standstill. An emergency planning drill took place at Seabrook in early July and, although FEMA gave a favorable preliminary report on the exercise, its final assessment will not be released before September.

Seabrook's licensing efforts may be bolstered, however, if President Reagan signs an Executive Order granting the FEMA preemptive authority to devise and implement emergency plans for nuclear plants when state or local officials refuse to participate. On July 11, the President met with a New Hampshire delegation opposing the proposal, which attempted to persuade him to reconsider the draft Order. President Reagan is expected to announce his decision in the near future.

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Carroll County 1 and 2

Commonwealth Edison's (CE) Carroll County 1 and 2 units are the only US reactors on order and not yet under construction. Designed as near replicas of Byron and Braidwood, the two PWRs are on indefinite hold, and could not be completed before the next century. CE is currently involved in disputes with the Illinois Commerce Commission on rate recovery for its final three nuclear units.

Orders for new reactors peaked in 1973 when 41 orders were placed, but the Carroll County units were the last ones made nearly a decade ago.

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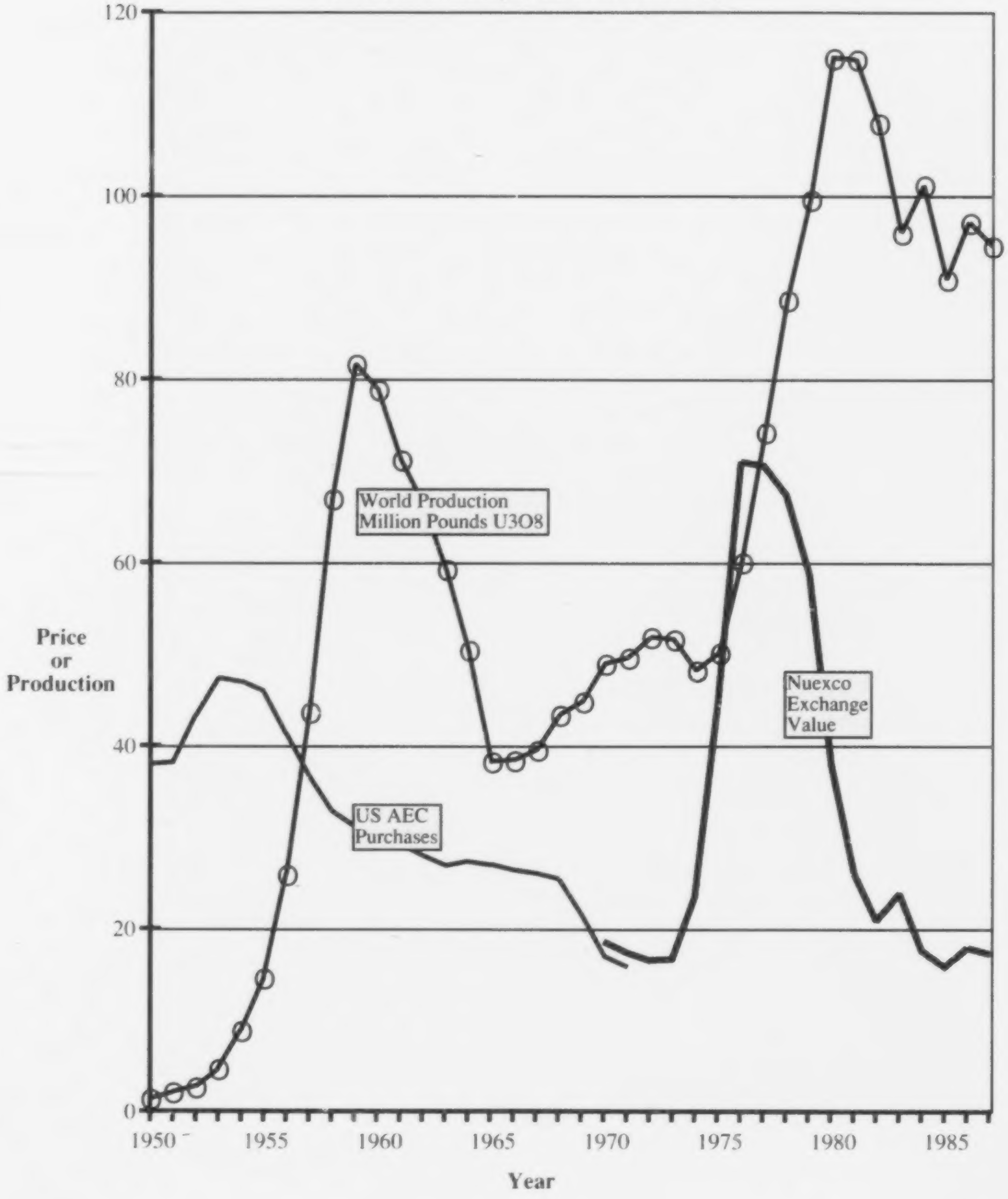
Figure 1

URANIUM PRICE AND PRODUCTION TRENDS

(Prices in January 1988 US $/Lb U3O8)



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WORLD URANIUM PRODUCTION FORECAST 1988-2000

This article incorporates portions of the world uranium production forecast contained in NUEXCO's 1988 Uranium Market Study and Price Forecast.

Introduction

Over the past five to seven years, the uranium industry has undergone significant restructuring, as excess inventories and the slow growth in consumption have caused production to decline.

Prior to 1985, production surpassed annual consumption in every year since the nuclear power era began. In 1985, however, this trend came to an end, and now world uranium production is expected to remain below consumption for several more years as excess inventories are gradually depleted. Once inventory selling and inventory drawdown have run their course, additional production will be necessary to fulfill demand. It is clear that this additional production will not come forth at today's spot market prices (see Figure 1). Although the market price for uranium and production costs will significantly affect the number of players entering or reentering the industry as well as individual production levels at that time, political developments will have the most impact on the distribution of production.

Current Political Uncertainties

Perhaps at this time more than any other, many political uncertainties threaten to shake up the current geographical distribution of uranium production. Some of the most prominent uncertainties facing uranium producers today include:

- the proposed US-Canada Free Trade Agreement,
- more restrictive economic sanctions against South Africa (enforced by the USA and other countries),
- the US Producers vs. DOE lawsuit - possible enrichment restrictions on foreign uranium in USA,
- the proposed US Government $750 million purchase program of domestic uranium,
- possible changes in the Australian floor price and three-mine policies,
- The merger of Canada's two largest uranium producers, Saskatchewan Mining Development Corporation and Eldorado Nuclear, Inc., and
- the tentative independence of Namibia which could result in ten percent of the world's production becoming more marketable.

Table 4
UNDEVELOPED AUSTRALIAN URANIUM DEPOSITS

Deposit	Ore Reserves Million Pounds U_3O_8	Ore Grade Percent U_3O_8
Anderson	7	0.20
Ben Lomond	10	0.16
Beverly	36	0.24
Bigryli	4	0.35
Honeymoon	7	0.16
Jabiluka	440	0.39
Kintyre	60	0.25
Koongarra	66	0.34
Lake Way	6	0.09
Mt. Painter	8	0.10
Officer Basin	22	No estimate
Skal	8	0.14
South Frome Group	11	No estimate
Valhalla	7	0.19
Westmoreland	25	0.17
Yeelirrie	115	0.15

In addition, the following market variables will have the most immediate effect on distribution and production levels over the next thirteen years:

- the length of time over which large inventories held by utilities and governments will be offered into the market, and
- whether low uranium prices will prevail and preclude recovering the high investment cost of new projects.

NUEXCO's Production Forecast

NUEXCO's world uranium production forecast for 1988-2000 shows a total of 1.6 billion pounds U_3O_8 compared to a projected world uranium production capability of 1.8

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Figure 2
WORLD PRODUCTION FORECAST
1988-2000

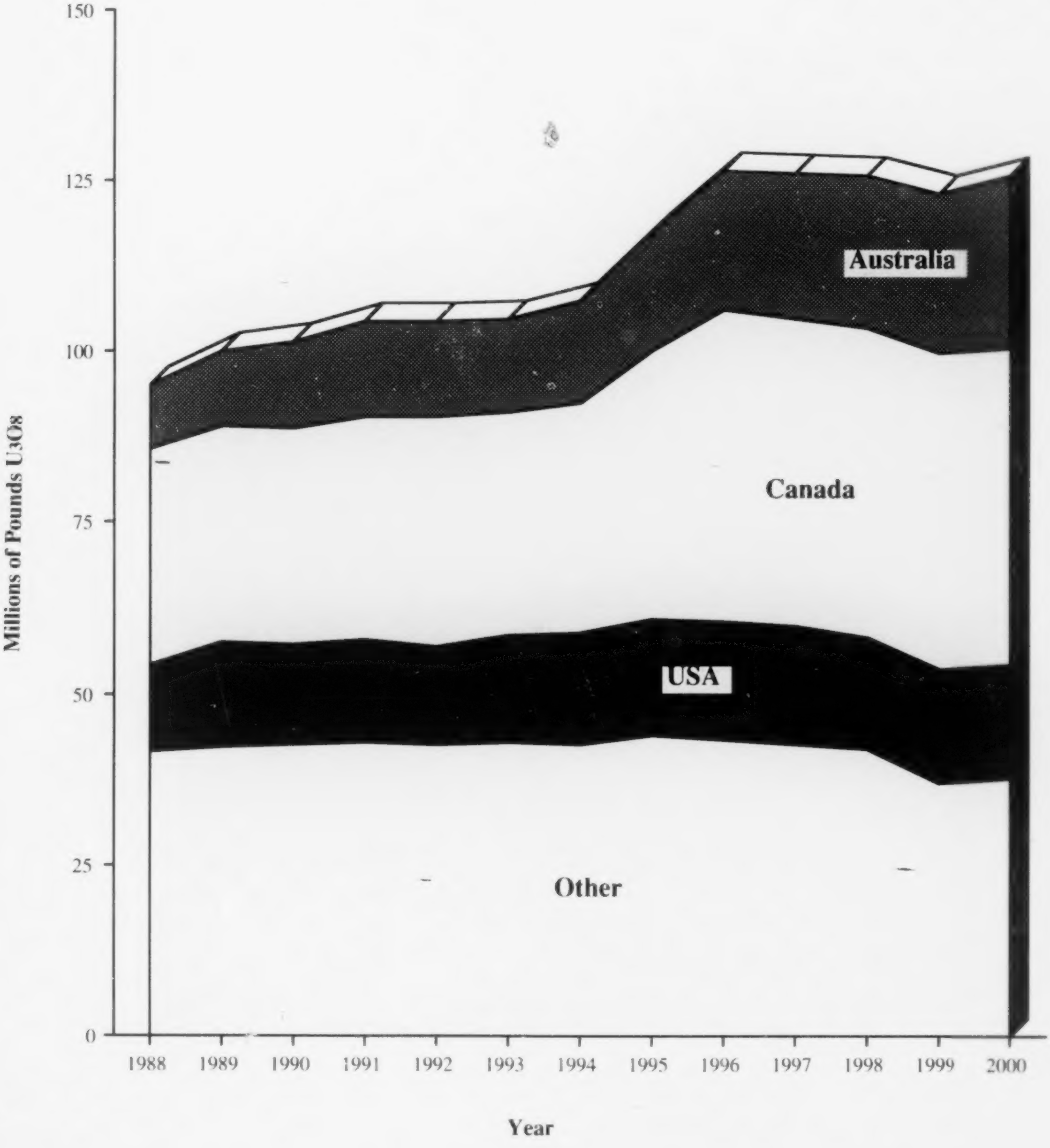

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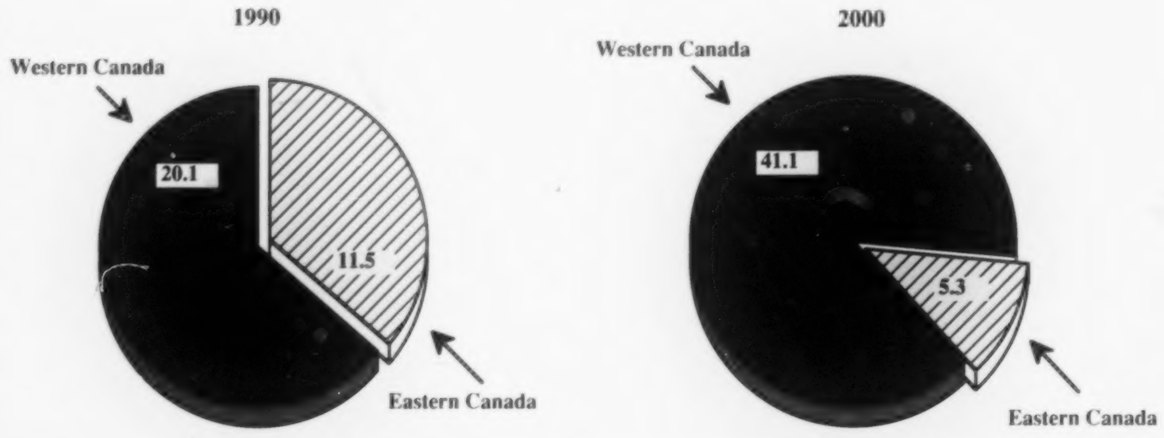
Figure 3
URANIUM PRODUCTION IN CANADA (Millions of Pounds U_3O_8)



billion pounds U_3O_8. Figure 2 shows projected uranium production by area.

Australia

Australia's uranium production industry appears likely to expand in the years ahead, though the precise rate and timing remain uncertain. At its biennial conference in June 1988, the Australian Labor Party (ALP) voted to review its uranium policies, providing fresh evidence of the ALP's willingness to recognize and deal with the realities of international uranium commerce.

In the Northern Territory, Queensland Mines (QML) has completed milling the stockpiled high-grade ore recovered from the Nabarlek deposit and, during the balance of 1988, will be processing some remaining lower-grade material. Assuming needed approvals are forthcoming as expected, development of the nearby Nabarlek II deposit will, beginning in 1989, provide ore for continued U_3O_8 production. It is also reported, though not confirmed, that QML will soon be in a position to resume investigation of previously-identified and very promising anomalies in the area surrounding the Nabarlek mill.

Energy Resources of Australia's (ERA) Ranger operation at Jabiru is projected to expand from its current level of seven million pounds U_3O_8 per year to ten million pounds in 1991 and to thirteen million by 1996. ERA continues to be an aggressive marketer, having signed thirteen long-term supply contracts with US utilities.

In South Australia, the Olympic Dam project is in a start-up mode, and while ore crushing has commenced, the first uranium output is not expected until early September. Olympic Dam's initial production rate is planned at four million pounds U_3O_8 per year, although only half of that amount is currently committed under long-term contracts.

Four other major projects (Jabiluka, Koongarra, Kintyre and Yeelirrie) are in the advanced planning stage and, assuming government approval to proceed, could increase Australia's production capability by as much as fourteen million pounds U_3O_8 by the year 2000. Table 4 shows the undeveloped uranium deposits in Australia.

Canada

Canada is and will continue to be the leading uranium producing country in the world, provided the Australian government policy does not dramatically change in the near term. Canadian production in 1987 totalled 32.3 million pounds U_3O_8, or about one-third of world production. The Canadian government has shown increased support for uranium development by reducing its Canadian ownership requirements for uranium project development from 67 percent to 51 percent (or even less,

Table 5
KNOWN UNDEVELOPED URANIUM DEPOSITS IN SASKATCHEWAN

Deposit	Ownership	Identified Resources (Million lbs U3O8)	Average Grade (% U3O8)	Approximate Depth (feet)
Cigar Lake	48.750% — SMDC 32.625% — Cogema 12.875% — Idemitsu 3.750% — Corona Grande 2.000% — KEPCO	385	11.6	1,400
Dawn Lake	100% — SMDC	30	1.8	400
Eagle North	33.33% — Eldorado 33.33% — SMDC 33.33% — Noranda	58	2.1	900
Eagle South	100% — Eldorado	75	1.6	1,100
McClean Lake	50% — Canadian Oxy 50% — Inco	14	1.8	500
Midwest	45% — Denison 20% — Bow Valley 20% — Midwest/Mink Mining 15% — Uranerz	57	1.3	700

provided Canadians maintain a "controlling interest" when Canadian partners cannot be found).

Historically, the province of Ontario (eastern Canada), with its extensive low-grade uranium deposits, dominated Canadian production. Saskatchewan production (western Canada) now holds the lead due to its high-grade, low-cost deposits, and this trend is projected to continue. The major Saskatchewan operation is Key Lake, but through the forecast period other major projects will include Cigar Lake, Dawn Lake, McClean Lake, Eagle, and Midwest (Table 5). After 1990, western Canadian production is forecast to rise rapidly, almost doubling over thirteen years, while output from eastern Canada (Denison, Panel, New Quirke, and Stanleigh mines) should be cut nearly in half during the same period. The eastern Canadian producers, Denison Mines and Rio Algom, have long-term supply contracts that, unless reduced in the next decade, will extend well into the next century, thus ensuring their continued success. However, Ontario Hydro has reduced some deliveries scheduled under its contracts, and is likely to continue its attempts to reduce its large inventories by reducing deliveries from higher-priced contracts. Figure 3 depicts NUEXCO's uranium production forecast in 1990 and the year 2000 for eastern and western Canada.

China

China's growing presence in the uranium market may provide more than five million pounds U_3O_8 per year by the year 2000, as its production capability and sizeable stockpile will enable it to compete with low-cost producers. Although its production costs are unknown, China's desire for western currency should provide sufficient incentive for its entry into the worldwide market.

France

There are currently only two companies actively producing uranium in France: Cogema produces approximately 7.1 million pounds U_3O_8 per year, and Total-Compagnie Française des Petroles produces approximately 1.4 million pounds annually. Since French production typically comes from small open-pit and underground mines that are milled centrally, NUEXCO believes these mines will play a progressively smaller role as additional lower-cost uranium becomes available from foreign sources.

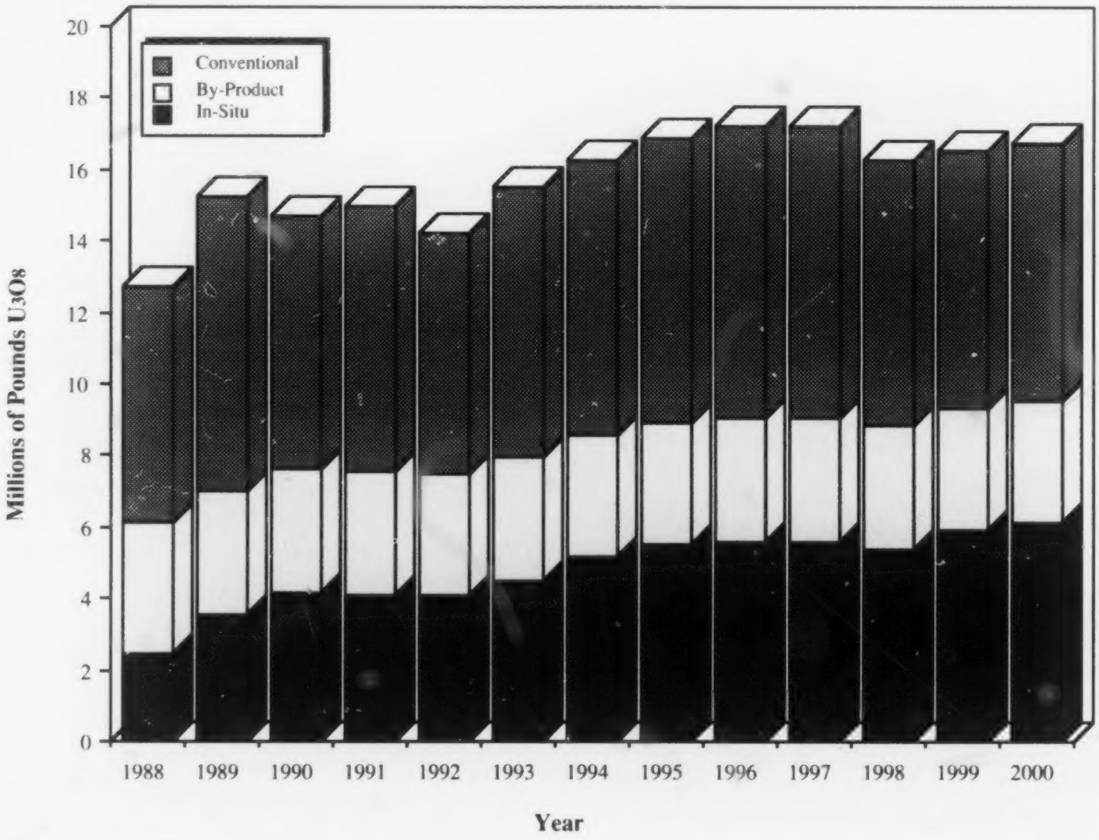
Gabon

A fairly efficient producer with large reserves, Gabon is likely to increase its uranium output over the next thirteen years. In 1987, Gabon produced about 50 percent of its rated capacity, or about two million pounds U_3O_8.

Namibia and South Africa

Despite the economic sanctions and political pressures many countries have enforced on South Africa and Namibia to discourage apartheid, production is expected

Figure 4
FORECAST OF US URANIUM PRODUCTION
By Category



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to remain at or near current levels because of ineffective sanctions. South Africa will consistently produce about ten million pounds per year through the end of the century unless more stringent and widespread political sanctions preclude additional sales. The producers in southern Africa have low-cost operations and can compete effectively on the world market, particularly in conjunction with the devaluation of the South African Rand.

If Namibia acquires its independence from South Africa, as is now under discussion, roughly ten percent of the world's uranium production may soon be accessible to most markets since the stigma of being classified as South African material will disappear. Having benefitted greatly from devaluation of the Rand and from increased operating efficiencies during the last several years, Rossing is expected to operate near its capacity of twelve million pounds per year through the year 2000.

Niger

Production from Niger is expected to continue its decline as the Somair operation at Arlit faces increasing difficulties in maintaining output at previous levels because of decreasing ore grades and increasing costs.

United States

The US production forecast presented here is based on a free-market scenario and is expected to increase from its present level of 12.5 million pounds to 15 million pounds in 1989, and to stabilize at the 17-million pound range through the end of the century. Overall, production emphasis in the USA is expected to switch from large-scale projects to flexible low-cost production from many smaller producers.

Conventional mining operations in the USA will only be feasible for a small group of cost-effective producers in the near to mid-term, and the average grade of conventionally-mined ores for the remainder of the decade is expected to be approximately 0.50 percent U_3O_8.

Solution mining will have a magnified role in future US production through a number of small to medium-sized projects. By 1990, several new US solution mining projects are expected to be in operation (see Table 6).

Table 6
US SOLUTION MINING PROJECTS PLANNED

Project Name	Owner	Operation Date
Christensen Ranch (Wyoming)	Malapai Resources	1989
Crow Butte (Nebraska)	Ferret Exploration	1990
Churchrock (New Mexico)	Uranium Resource Inc.	1990

Uranium as a by-product from phosphoric acid production in the USA is under some pressure as most production costs remain in excess of the spot price for U_3O_8. No new major production centers are expected to come on stream in the foreseeable future. Figure 4 shows the forecast of uranium production by category in the USA through the year 2000.

Other Countries

A number of other countries produce small quantities of uranium primarily to supply their own needs. These countries include Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain and Yugoslavia. Marginal increases at best are foreseen for these producers.

Conclusion

This production forecast from NUEXCO's Uranium Market Study is based on long-term prices that are considerably higher than today's spot market prices, although they are lower in constant-dollar terms than the previous historical peak in spot prices. Historical data support the notion that prices in new contracts signed for long-term delivery (for contracts specifying prices) have generally reflected a premium over spot market prices that were prevalent at the time of contract signing. Required production increases will be possible, but not at today's spot price level.

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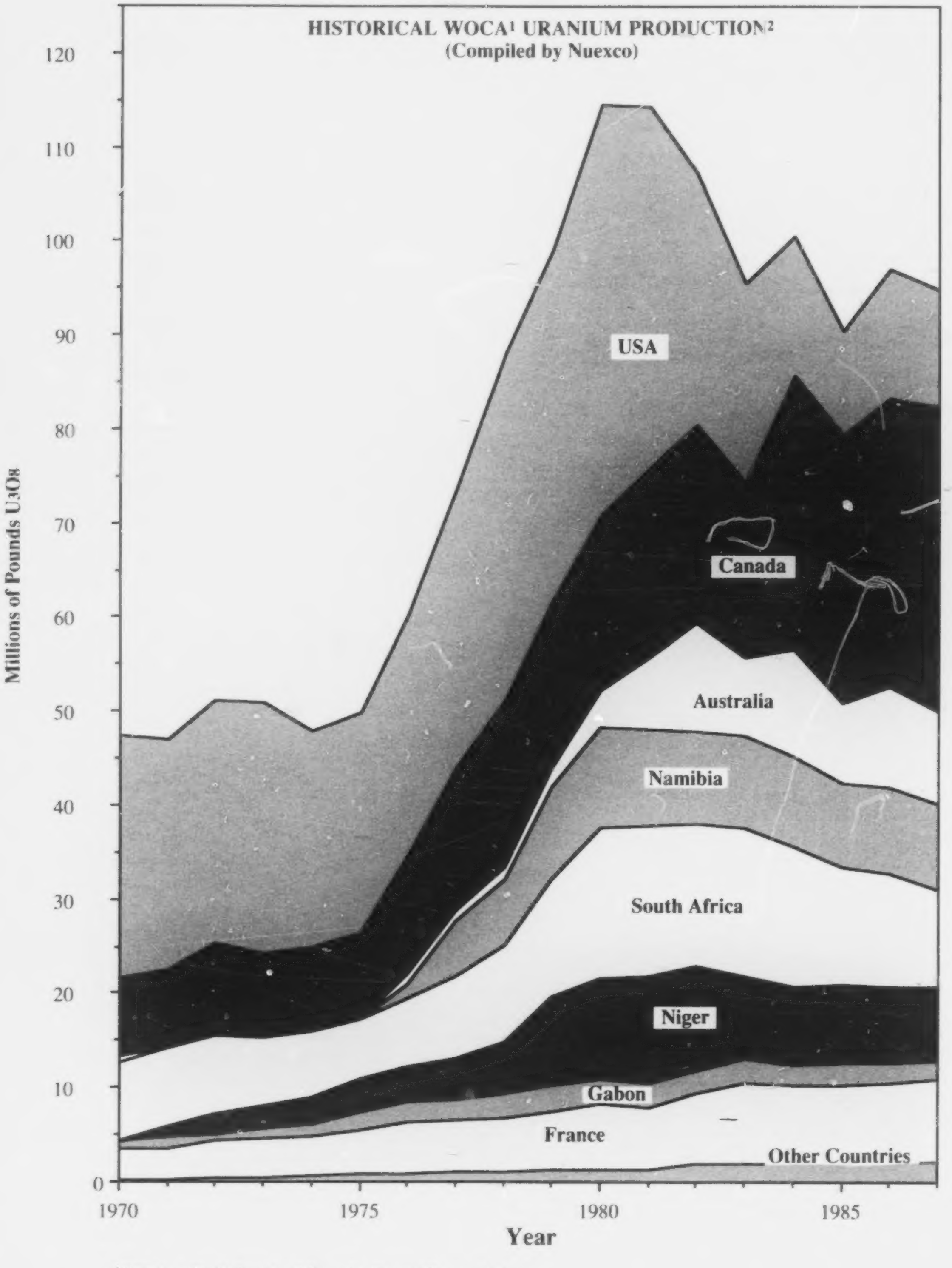

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[1] WOCA = World Outside of Centrally-Planned Economic Areas.
[2] 1987 production data are preliminary.

SOUTH AFRICA

Second quarter output from South African Chamber of Mines producers totalled 2,607,894 pounds U_3O_8, a 4.37 percent increase over the first quarter of 1988.

Six mines showed higher production levels, three of which were up by more than ten percent. Buffelsfontein reported the greatest increase over last quarter of 15.5 percent, while Driefontein Consolidated had the most dramatic decline in production — 22.7 percent.

Randfontein experienced a 12-percent decrease in production due to difficulties in maintaining recovery grades. Contract discussions are now underway with Randfontein's major customer, the French nuclear agency, which financed construction of the Ranfontein uranium recovery plant.

The pay dispute between South Africa's National Union of Mineworkers and the Chamber of Mines was resolved this month, and the Union agreed to accept a sliding scale wage increase of 13 to 16.5 percent. This marks the lowest wage increase in years, barely above South Africa's current 13.4-percent inflation rate. The agreement also provides for the establishment of a provident fund for black mineworkers. One year ago, a lengthy strike called by the Mineworkers Union appreciably disrupted South African production.

Table 7
REPUBLIC OF SOUTH AFRICA
RECENT URANIUM PRODUCTION[1]
(Thousands of Pounds U308)

First Quarter Operation	Third Quarter 1987	Fourth Quarter 1987	First Quarter 1988	Second Quarter 1988	Percent Change[2]
Buffelsfontein	240	229	214	247	+15.5
Driefontein Consolidated	42	36	40	31	-22.7
ERGO[3]	85	93	104	99	-5.4
Freegold[4]	245	223	257	284	+10.8
Harmony	97	90	88	89	+.5
Hartebeestfontein	223	219	212	202	-4.6
Randfontein	148	259	249	219	-12.0
Stilfontein (Chemwes)	232	239	255	272	+6.8
Vaal Reefs	768	927	977	1,052	+7.7
Western Areas	124	98	102	112	+10.3
TOTAL[5]	**2,184**	**2,467**	**2,499**	**2,608**	**+4.37**

[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.

[2] Change in percent from the fourth quarter of 1987.

[3] ERGO = East Rand Gold and Uranium Company Ltd.

[4] Formerly Free State Joint Metallurgical Scheme.

[5] Columns may not add up due to rounding.

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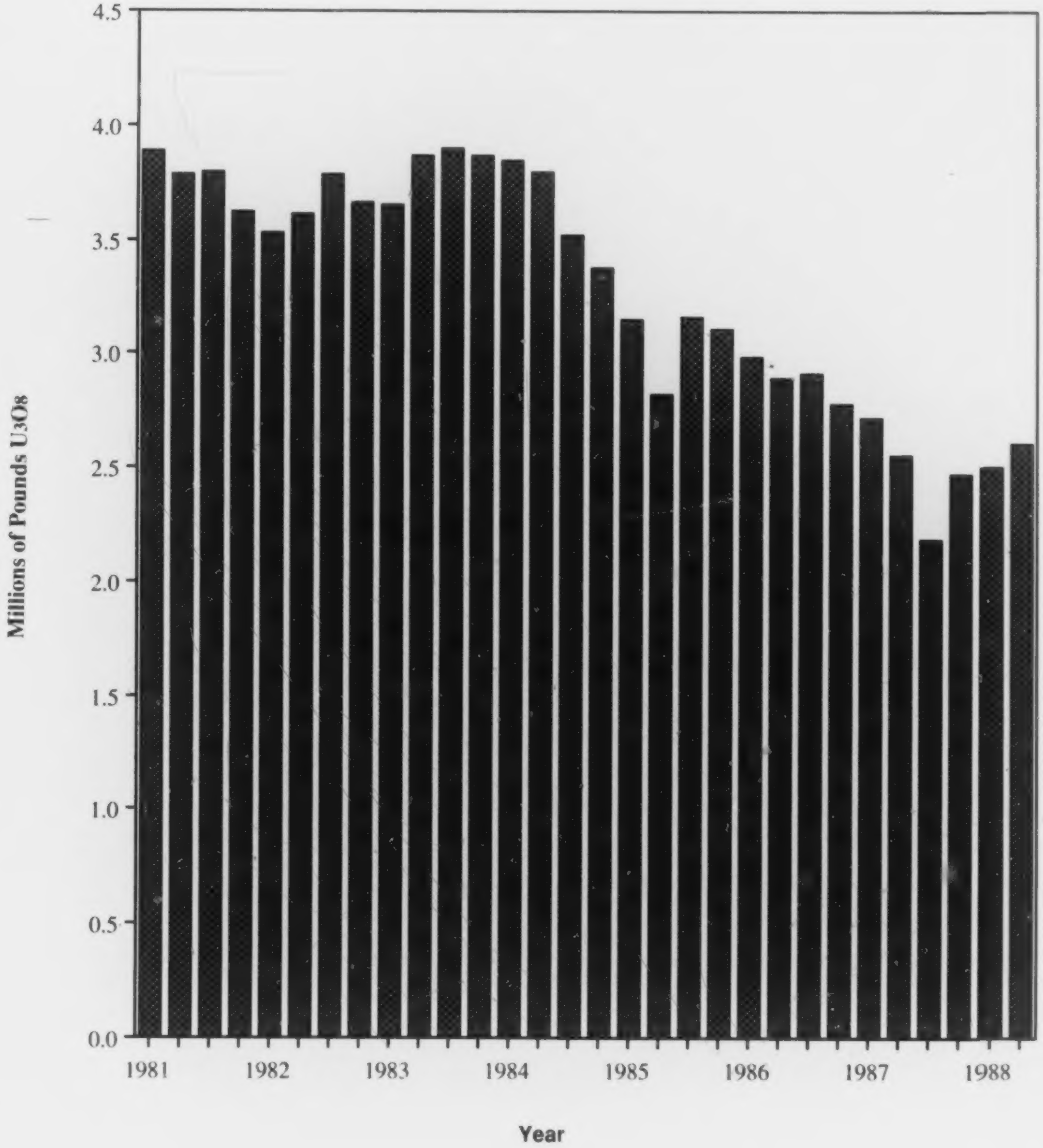
Figure 5
REPUBLIC OF SOUTH AFRICA
QUARTERLY URANIUM PRODUCTION



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	**14.75**					

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	**0.00**					

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	**15.45**					

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF₆)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.80	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	**1.85**					

HISTORICAL UF₆ VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF₆)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	**42.75**					

HISTORICAL US UF₆ PREMIUM (Relative to the UF₆ Value)

Determined as of the last day of the month indicated ($US/kg U as UF₆)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	**0.00**					

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay)

Determined as of the last day of the month indicated ($US per SWU)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	**68**					

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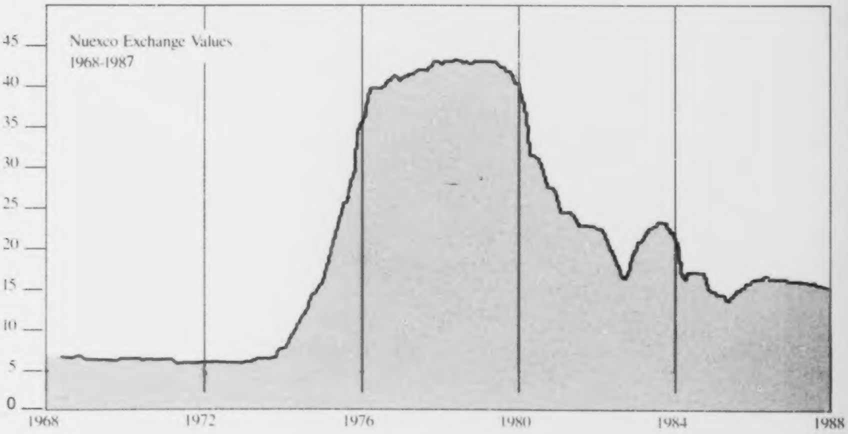
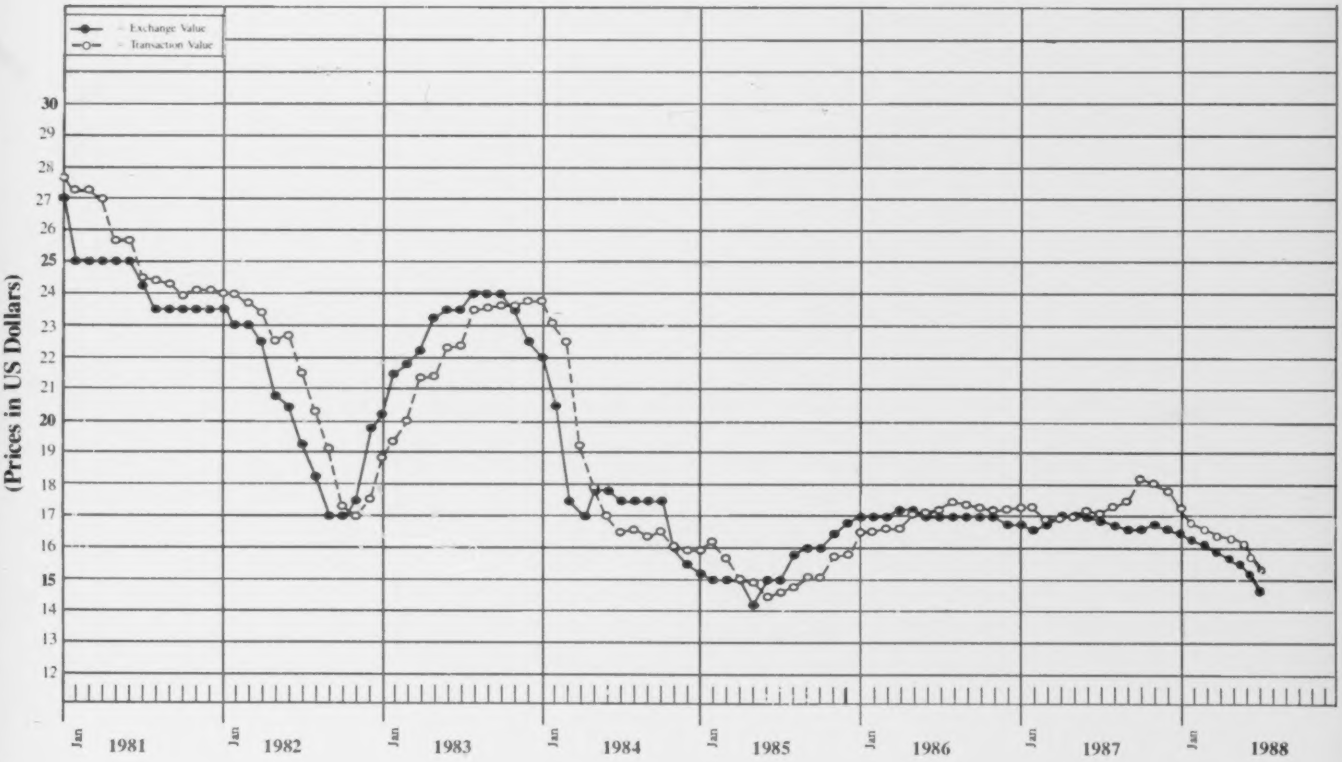
HISTORICAL MARKET DATA





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US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6
1987	13.1P		$27.45P	14.0P	$19.31P	

P = Preliminary

[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Resources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, Assistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[2] Sources: 1976-11982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]

(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	198.7 (Jan - May) 101.1 (Jun - Dec)[5]
1986	Avg.	155.5	101.5	104.9
1987	Avg.	168.7	108.9	—
Jan	1987	—	106.2	108.8R
Feb	1987	—	108.9	108.8R
Mar	1987	164.7	108.4	111.7R
Apr	1987	—	108.3	111.7R
May	1987	—	108.1	111.7R
June	1987	167.2	108.1	111.8R
July	1987	—	108.7	111.9R
Aug	1987	—	110.5	111.9R
Sep	1987	170.0	109.3	112.1R
Oct	1987	—	108.6	112.2R
Nov	1987	—	110.0	112.2R
Dec	1987	172.9	111.9	112.3R
Jan	1988	—	112.4	—
Feb	1988	—	112.3	—
Mar	1988	176.0	112.3	—
Apr	1988	—	112.4	—

P = Preliminary **R** = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

[5] Base: June 1985 = 100 and includes salary earners as well as wage earners.

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GOVERNMENT STATISTICS

CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.1	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.5	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1	140.4	20.47	17.50	16.50	12.63	13.53
Dec	1987	125.5	140.5	20.62	17.31	16.37	12.54	13.75
Jan	1988	126.4	140.8	20.70	17.54	16.65	12.82	13.73
Feb	1988	125.9R	141.3	20.94	17.97	17.07	13.01	13.69
Mar	1988	126.2R	142.0	20.55	17.88	16.78	13.10	13.62
Apr	1988	126.8R	142.5	20.03R	18.50R	15.92R	13.32R	13.66R
May	1988	127.2R	143.4	22.47P	18.59P	16.11P	13.33R	13.58P
Jun	1988	127.1	143.6	—	—	—	—	—

P = Preliminary **R** = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975	Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976	Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977	Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978	Avg	27.14	—	40.3	74.3	658,261	1,502,975
1979	Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	—	—	137.7	246.8	750,256	—
Jan	1987	—	—	128.9	233.9	750,496	529,682
Feb	1987	—	—	130.3	237.0	758,230	600,258
Mar	1987	88.17	197.1	132.4	239.6	763,003	536,033
Apr	1987	—	—	134.1	242.5	765,309	535,876
May	1987	—	—	135.6	243.6	761,026	531,732
Jun	1987	90.74	203.5	136.6	244.9	763,319	571,407
July	1987	—	—	138.2	246.8	764,810	624,954
Aug	1987	—	—	140.2	249.9	761,338	564,387
Sep	1987	100.79	224.7	142.0	252.4	742,417	587,707
Oct	1987	—	—	143.6	255.5	725,599	599,116
Nov	1987	—	—	144.8	256.3	734,630	616,725
Dec	1987	100.34	267.0	145.9	258.3	712,896	613,262
Jan	1988	—	—	147.2	261.5	711,983	615,889
Feb	1988	—	—	148.2	265.7	730,313	619,159
Mar	1988	102.96	234.0R	150.2	268.4	—	619,117
Apr	1988	—	—	151.9	272.7	—	621,757
May	1988	—	—	153.1	276.1	—	—
Jun	1988	—	—	153.6	—	—	—

P = Preliminary **R** = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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GOVERNMENT STATISTICS

UNITED STATES

		Producer Price Index[1]				Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	Consumer Price Index[2] (1982-1984 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	111.2	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	114.1	12.46R	13.48R	11.98	9.65
1987	Avg.	102.6	102.8	113.6	—	12.52	12.98	12.37	9.88
Jan	1987	100.4	100.5	111.2	—	12.72R	12.96R	12.17R	9.82R
Feb	1987	100.8	101.0	111.6	—	12.63R	12.80R	12.21	9.82R
Mar	1987	101.1	101.2	112.1	116.1	12.58R	12.76R	12.24	9.82R
Apr	1987	101.6	101.9	112.7	—	12.51R	12.84R	12.30	9.81R
May	1987	101.9	102.6	113.1	—	12.50R	12.87R	12.32R	9.81R
Jun	198	102.4	103.0	113.5	117.2	12.52R	12.88R	12.28R	9.83R
Jul	1987	103.1	103.5	113.8	—	12.41R	13.02R	12.37	9.86R
Aug	1987	103.7	103.8	114.4	—	12.40R	13.01R	12.33R	9.98R
Sep	1987	103.5	103.7	115.0	117.8	12.50R	13.29R	12.56	9.94R
Oct	1987	104.0	104.1	115.3	—	12.42R	12.99R	12.50R	9.92R
Nov	1987	104.2	104.2	115.4	—	12.54R	13.11R	12.55R	9.98R
Dec	1987	104.1	104.1	115.4	118.7	12.60R	13.14	12.61R	10.03R
Jan	1988	104.3	104.5	115.7	—	12.77R	13.03R	12.55R	10.02R
Feb	1988	104.6R	104.8R	116.0	—	12.71R	12.96R	12.55	10.02R
Mar	1988	104.7	104.9	116.5	119.4	12.59R	13.17R	12.53R	10.04R
Apr	1988	105.6	105.8	117.1	—	13.08	13.17	12.57R	10.09R
May	1988	106.1	106.5	117.5	—	12.96P	13.09P	12.57R	10.12
Jun	1988	106.5	107.4	118.0	120.6	—	—	12.62P	10.13P

P = Preliminary **R** = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price
Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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EXECUTIVE SUMMARY
REPORT 240
(All data as of July 31, 1988)

Exchange Value **\$14.75, down \$0.35**	The **Exchange Value** is **\$14.75** per pound U_3O_8, down \$0.35 since last month. The **US Premium** (relative to the Exchange Value) is unchanged at **zero**.
UF_6 Value **\$42.75, down \$1.25**	The **UF_6 Value** is **\$42.75** per kg U as UF_6, down \$1.25 since last month. The **US Premium** (relative to the UF_6 Value) remains at **zero**.
Transactions	**Ten** recent natural uranium sales are reported, involving approximately **5.0 million** pounds equivalent U_3O_8. Seven of these sales involved spot or near-term delivery, and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **7.9 million** pounds U_3O_8 equivalent, an increase of 500,000 pounds since last month. Active spot and near-term **uranium demand** totals **1.7 million** pounds, up 400,000 pounds since last month. The spot and near-term **supply-demand ratio** fell to **4.6** from 5.5.
Transaction Value **\$15.45, down \$0.35**	The **Transaction Value** is **\$15.45** per pound U_3O_8, **down \$0.35** since last month. The calculation includes 15 transactions involving a total of more than 2.4 million pounds U_3O_8 and equivalent UF_6 and covers a period of 3 months.
Loan Rate **3.5%, unchanged**	The **Loan Rate** is **3.5 percent** per annum, unchanged. One loan transaction is reported.
Conversion Value **\$1.85, up \$0.05**	The **Conversion Value** is **\$1.85** per pound U as UF_6, an increase of \$0.05 since last month. No secondary market transactions for conversion services took place this month. Active demand totals 1.3 million pounds U as UF_6.
SWU Value \$68, **unchanged**	The **SWU Value** at 0.3% tails assay is **\$68** per SWU, unchanged since last month. No secondary market SWU transactions are reported this month.

* * *

Analysis and Commentary	The US nuclear power plant backlog continues to decline, and only seventeen units now remain. NUEXCO forecasts world uranium production over the period 1988 to 2000 to total 1.8 billion pounds U_3O_8.
Recent Developments	Second quarter 1988 production from the Republic of South Africa increased by more than four percent over the previous quarter.

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NUEXCO REPORT 240 FIGURES OF THE MONTH (July 31, 1988)	This Month (Report 240)	Last Month (Report 239)	12 Months Ago (Report 228)
Exchange Value ($US per pound U_3O_8)	14.75	15.10	16.75
US Premium for the Exchange Value ($US per pound U_3O_8)	0	0	2.50
UF_6 Value ($US per kg U as UF_6)	42.75	44.00	47.50
US Premium for the UF_6 Value ($US per kg U as UF_6)	0	0	6.50
Transaction Value ($US per pound U_3O_8 equivalent)	15.45	15.80	17.30
Loan Rate (Per Annum)	3.5%	3.5%	3%
Conversion Value ($US per pound U as UF_6)	1.85	1.80	1.90
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	7.9	7.2	2.8
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	1.7	1.3	2.5
Near-Term Supply-Demand Ratio	4.6	5.5	1.1
Recent Uranium Sales:[3]			
Number of Transactions	10	8	8
Quantity of Material (Millions of pounds U_3O_8 equivalent)	5.0	8.4	1.8
Nuexco SWU Value: ($US per SWU)			
at 0.3 tails assay	68	68	75
US DOE SWU Prices: ($US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6[8]: ($US per kg U as UF_6)			
2.5 w/o U_{235}	401	405	447
3.0 w/o U_{235}	513	518	572
3.5 w/o U_{235}	627	633	699
4.0 w/o U_{235}	742	750	827

Active inquiries to sell, for delivery within 12 months after contract signing.

Active inquiries to purchase, for delivery within 12 months after contract signing.

Uranium sales only; does not include loans, conversion, or SWU transactions.

Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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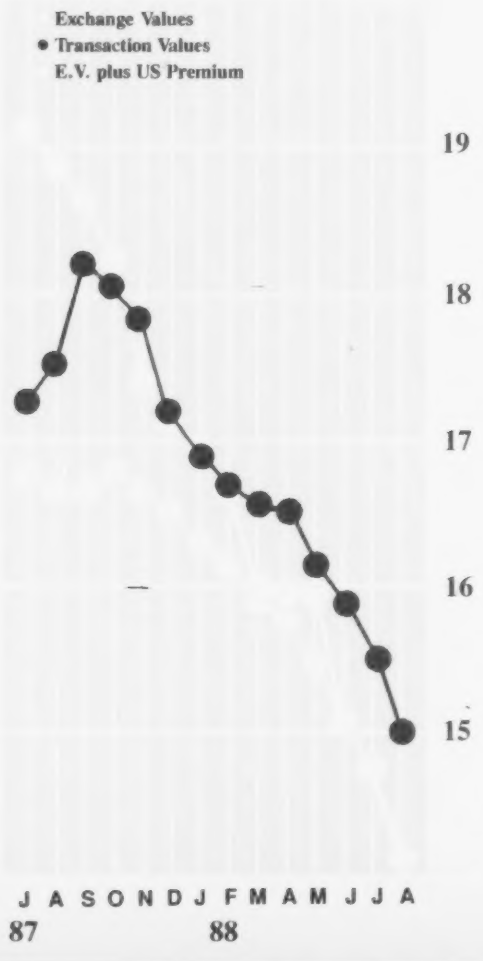

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

September 1988 **No. 241**

R. GENE CLARK, *EDITOR* **FRANCE A. HEAD, *ASSOCIATE EDITOR***

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To Our Readers

* * *

Five months ago, we noted the founding of NUEXCO in May 1968, and this month we celebrate the twentieth anniversary of the NUEXCO Monthly Report.

Changing market conditions significantly influenced the content and growth of the Monthly Report over the past twenty years, and led to the establishment of the various NUEXCO market values. On page 25 of this issue we have reprinted the first NUEXCO Monthly Report cover and the market values table which were published in September 1968. At that time, the NUEXCO Monthly Report consisted of three pages, and listed yellowcake and UF_6 deposits and loan requests, in addition to the market values.

In search of a historical perspective on the nuclear power industry and the forces that gave rise to NUEXCO's formation and development, we interviewed George White, one of NUEXCO's co-founders, and Bob Wolcott, an early director of the company, who reminisced about those early years.

We also thought it would be interesting to step back even further in time and explore how uranium was first discovered and what its applications were prior to the nuclear power age.

We direct our many thanks to you, our supportive readers, for the success of the Monthly Report, as we continue striving to meet your business needs for selective and timely information, analyses, recent developments, and feature articles.

* * *

NUEXCO will be hosting a hospitality suite at the U.S. CEA Uranium Seminar to be held September 25-28 in Tucson, Arizona. We look forward to seeing you there.

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MARKET VALUES SUMMARY

August 31, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE[1]	**\$14.15**/lb U_3O_8	7,300[2]	1,574[2]
US Premium[7]	**- 0 -**		
UF_6 VALUE[2]	**\$41.00**/kg U as UF_6	7,300[2]	1,574[2]
US Premium	**- 0 -**		
CONVERSION VALUE[3]	**\$1.95**/lb U as UF_6	0	900
SWU VALUE[4]			
0.3 tails assay:	**\$65**/SWU	770	95
LOAN RATE[5]	**3.5%**/annum	5,950	0

	\$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE[6]	**15.00**	**2.9**	**15**	**3**

[1]Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

[2]For either uranium concentrates or uranium hexafluoride.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers.
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of August 31, 1988)

Market volume increased this month with approximately 6.8 million pounds U_3O_8 equivalent traded in five near-term and two long-term transactions. In the secondary conversion market, the two transactions reported last month as pending were concluded during August. One secondary SWU transaction took place involving DOE-origin SWU.

The **Exchange Value** fell to **$14.15** per pound U_3O_8, a $0.60, or more than four percent, decrease from last month, as recent transactions and aggressive sellers continue to exert downward pressure on uranium prices. The Exchange Value is now at its lowest level since October 1974, and in real dollars (adjusted for inflation), it represents the lowest price level ever during the 20 years the NUEXCO Exchange Value has been published (see Figure 1). The steady price decline over the past year reflects the continued availability of low-priced supply from a variety of sources, several of which are offering significant quantities of U_3O_8 at prices near the Exchange Value.

Contrary to classic economic principles, the appearance of new buyers in the current market has led to downward pressure on prices as numerous sellers competed aggressively for every sales opportunity that became available. As long as these sellers remain in the market, this dynamic is likely to continue, and even moderate increases in demand may fail to generate higher prices. Suppliers include US and non-US producers interested in moving large quantities of new production as well as inventories, European entities with large inventories, and material liberated through complex transactions. Excess inventories now approximate 200 million pounds U_3O_8 equivalent, or nearly two years of forward requirements.

Essentially all market participants — utilities, producers, traders, and consultants — tend to agree that current spot price levels are too low to motivate and sustain, in the long-term, production of sufficient uranium to meet future reactor requirements. That the market should behave in a manner so contrary to the apparent long-term interests of both utilities and producers has been a matter of continuing concern and frustration.

Factors inhibiting any near-term price recovery include:

- the reduction and deferral of real uranium demand as a consequence of excess inventories,
- the continued availability of low cost and/or low-priced uranium from new suppliers of natural and enriched material now competing for market share, and
- continued competition from less conventional transactions involving de-enrichment and deconversion swaps and liquidations of the excess inventories.

In addition, most current procurement activity in the spot market is discretionary and thus extremely price sensitive. Almost all buyers have been able to obtain comparable and increasingly favorable contract terms. In hindsight, it may well be that the timing of the current price decline has been merely deferred and its severity perhaps increased, as a consequence of legal and political events which interferred, albeit only temporarily, with the free interaction of the normal market forces of supply and demand.

Six U_3O_8 transactions are reported this month involving approximately 6.5 million pounds, four of which were for near-term delivery. Two transactions which were concluded early in the month were at prices slightly higher than those finalized near the end of the month, and involved a relatively scarce origin attractive to some utilities because of its unrestricted nature. Three buyers are now in the market for U_3O_8 for delivery prior to year-end. The impending market response to their requests, totaling about 700,000 pounds U_3O_8, will provide an indication of whether prices will stabilize at the current level or decline further.

* * *

The **US Premium** for **U_3O_8** remains at zero, as most buyers refuse to pay a premium for US-origin material. In addition, most suppliers are willing to sell US-origin material at current prices, and it appears that very few sellers believe a premium is attainable in the current market. Legislative uncertainties and stagnation in the US Producer vs. DOE lawsuit has focused attention on the US-Canada Free Trade Agreement (FTA), which has been approved in the USA by the House and is expected to pass in the Senate this fall, but has encountered difficulties in Canada. Anti-FTA forces in Canada may have succeeded in making the FTA an election issue, which could jeopardize or delay its passage.

* * *

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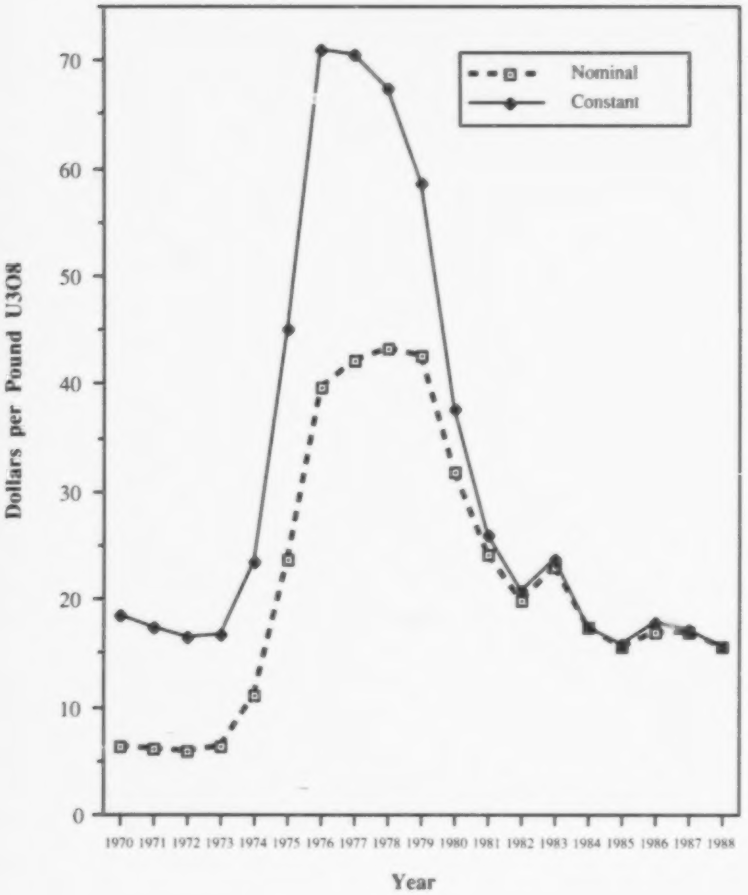
Figure 1
HISTORICAL NUEXCO EXCHANGE VALUES
(Annual Average)



The **Transaction Value** declined to **\$15.00** per pound U_3O_8, a \$0.45 reduction from the prior month, as higher-priced transactions from May were removed from the calculation. The calculation extends over a three-month period and includes 15 transactions involving approximately 2.9 million pounds U_3O_8 equivalent.

* * *

The **UF_6 Value** declined to **\$41.00** per kilogram U as UF_6, a \$1.75 change from the previous month, in response to the same pressures that affected the Exchange Value. One entity's attempts to sell a large quantity of UF_6 inventory has been met with little interest, and potential buyers are seeing increasingly aggressive offers. One UF_6 transaction was concluded this month at a price near the current value, but little firm demand for UF_6 is anticipated through year-end. The **US Premium** for **UF_6** also remains at zero, and has been affected by the same factors as the US Premium for U_3O_8.

* * *

The **Loan Rate** is unchanged at **3.5 percent** per annum, and one U_3O_8 loan transaction is reported. There continues to be little demand for loans in a market in which purchases are so economically attractive.

* * *

Active supply of natural uranium (concentrates and UF_6) for spot delivery totals **7.3 million pounds** U_3O_8 equivalent, a decrease of approximately 600,000 pounds since last month. **Active demand** for natural uranium also dropped slightly to **1.6 million pounds**, from the 1.7 million pounds previously reported. The net result of these fluctuations is an unchanged **supply/demand ratio** of **4.6 to 1** for the near-term.

The **Conversion Value** rose to **\$1.95** per pound U as UF_6, an increase of \$0.10, in response to a strengthening secondary conversion market. Several utilities have expressed interest in significant quantities of conversion services over the next nine months, straining available UF_6 supplies, particularly when origin restrictions are applied. Although UF_6 supplies for sale remain abundant, conversion transactions require the disposal of U_3O_8 liberated from the transaction, which sharply limits the

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availability of these types of transactions. Two secondary conversion transactions are reported this month; one involved a European buyer and took place at a price slightly above the current value, and is representative of the somewhat stronger European market for conversion.

ENRICHMENT SERVICES AND SWU

The **SWU Value** dropped to **$65 per SWU**, a $3-per-SWU reduction, in light of low-priced offers in the market. One sale of DOE-origin SWU was completed on a spot basis, another transaction for longer-term supply is in negotiation, and several others could be concluded soon to fulfill requirements in the 1991-95 timeframe. The emergence of low-priced supply has drawn discretionary buyers into the marketplace, resulting in a more active SWU market than in early 1988.

* * *

US LEGAL AND POLITICAL DEVELOPMENTS AUGUST 1988

Aug. 2 – The House voted to renew the **Price-Anderson Act** for an additional 15 years, raising the total potential funds available in the case of a nuclear accident to $7 billion. The Senate gave its approval on August 5, and the Act was subsequently signed into law by President Reagan.

Aug. 8 — The Senate passed the **Nuclear Regulation Reorganization & Reform Act (S. 2443)** which provides for the reorganization of the Nuclear Regulatory Commission (NRC), encourages a rulemaking on standardization of nuclear power plant designs, and includes the uranium compromise package establishing a $750 million government purchase program for domestic uranium, a uranium mill tailings fund, and a government-owned uranium enrichment corporation. The House is not expected to support this bill because of strident opposition to the uranium compromise package. The uranium package may yet be tacked onto another bill if S. 2433 is unsuccessful.

Aug. 9 — The House passed the implementing legislation for the US/Canada Free Trade Agreement (FTA) by a 366 to 40 vote, and the Senate Energy & Natural Resources Committee also approved the legislation. Although it still must be reviewed by several other Senate committees, it is expected to reach the Senate floor for full consideration sometime in September and pass. In Canada, the House of Commons approved the Agreement, and it has now moved on to the Senate where its future is uncertain.

Aug. 11 — The House approved a revised version of the **South African sanctions bill** which would prohibit the import of South African UF6. On September 8, the Senate Foreign Relations Committee is scheduled to mark up the sanctions bill which, if revised, is likely to be less comprehensive than the House version. It is uncertain whether the bill will reach the Senate floor before Congress adjourns in October.

Aug. 17 — US District Court Judge James Carrigan has ordered a conference on October 12 to schedule further proceedings in the **US Producers vs. DOE lawsuit**.

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	**This Month (August 31, 1988)**	**Last Month (July 31, 1988)**	**12 Months Ago (August 31, 1987)**	**This Month (August 31, 1988)**	**Last Month (July 31, 1988)**	**12 Months Ago (August 31, 1987)**
Australia (dollar)	17.57	18.35	23.41	45.67	47.70	60.86
Belgium (comm. franc)	554.03	574.60	627.59	1,440	1,494	1,632
Canada (dollar)	17.50	17.82	21.94	45.49	46.34	57.05
EEC (ecu)	12.75	13.11	14.61	33.16	34.09	37.99
Finland (markka)	62.64	64.98	73.25	162.85	168.93	190.44
France (franc)	89.61	92.65	100.73	232.98	240.87	261.86
FRG (mark)	26.41	27.49	30.16	68.66	71.48	78.42
Italy (lira)	19,598	20,311	21,845	50,951	52,805	56,791
Japan (yen)	1,910	1,953	2,363	4,964	5,076	6,144
Netherlands (guilder)	29.81	31.05	33.99	77.51	80.71	88.38
South Africa (rand)	34.37	35.96	33.91	89.35	93.48	88.16
Spain (peseta)	1,748	1,812	2,031	4,544	4,710	5,281
Sweden (krona)	91.17	94.13	106.19	237.03	244.71	276.06
Switzerland (franc)	22.30	22.86	24.85	57.98	59.43	64.61
UK (pound)	8.38	8.56	10.19	21.78	22.26	26.50
US (dollar)	14.15	14.75	16.65	36.79	38.35	43.29

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
Country (currency)	**This Month (August 31, 1988)**	**Last Month (July 31, 1988)**	**12 Months Ago (August 31, 1987)**	**This Month (August 31, 1988)**	**Last Month (July 31, 1988)**	**12 Months Ago (August 31, 1987)**
Australia (dollar)	18.62	19.22	24.68	48.41	49.96	64.15
Belgium (comm. franc)	587.31	601.87	661.52	1,527	1,565	1,720
Canada (dollar)	18.55	18.67	23.13	48.22	48.54	60.13
EEC (ecu)	13.52	13.73	15.40	35.15	35.71	40.04
Finland (markka)	66.40	68.06	77.21	172.63	176.94	200.73
France (franc)	95.00	97.05	106.17	246.97	252.30	276.02
FRG (mark)	28.00	28.80	31.79	72.78	74.87	82.66
Italy (lira)	20,776	21,275	23,025	54,012	55,311	59,861
Japan (yen)	2,024	2,045	2,491	5,263	5,317	6,476
Netherlands (guilder)	31.61	32.52	35.83	82.17	84.54	93.15
South Africa (rand)	36.43	37.66	35.74	94.72	97.92	92.92
Spain (peseta)	1,853	1,898	2,141	4,817	4,933	5,566
Sweden (krona)	96.65	98.60	111.93	251.27	256.33	290.98
Switzerland (franc)	23.64	23.95	26.19	61.46	62.25	68.10
UK (pound)	8.88	8.97	10.74	23.09	23.31	27.93
US (dollar)	15.00	15.45	17.55	39.00	40.17	45.63

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb U as UF6			per kg U as UF6		
Country (currency)	**This Month (August 31, 1988)**	**Last Month (July 31, 1988)**	**12 Months Ago (August 31, 1987)**	**This Month (August 31, 1988)**	**Last Month (July 31, 1988)**	**12 Months Ago (August 31, 1987)**
Australia (dollar)	2.42	2.30	2.67	5.34	5.07	5.89
Belgium (comm. franc)	76.35	72.07	71.62	168.32	158.88	157.89
Canada (dollar)	2.41	2.24	2.50	5.32	4.93	5.52
EEC (ecu)	1.76	1.64	1.67	3.87	3.63	3.68
Finland (markka)	8.63	8.15	8.36	19.03	17.97	18.43
France (franc)	12.35	11.62	11.49	27.23	25.62	25.34
FRG (mark)	3.64	3.45	3.44	8.02	7.60	7.59
Italy (lira)	2,701	2,548	2,493	5,954	5,616	5,496
Japan (yen)	263.16	244.90	269.69	580.16	539.92	594057
Netherlands (guilder)	4.11	3.89	3.88	9.06	8.58	8.55
South Africa (rand)	4.74	4.51	3.87	10.44	9.94	8.53
Spain (peseta)	240.86	227.22	231.79	531.00	500.93	511.01
Sweden (krona)	12.56	11.81	12.12	27.70	26.03	26.71
Switzerland (franc)	3.07	2.87	2.84	6.78	6.32	6.25
UK (pound)	1.15	1.07	1.16	2.55	2.37	2.56
US (dollar)	1.95	1.85	1.90	4.30	4.08	4.19

SWU VALUE AND UF6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	SWU Value at 0.30% Tails Assay This Month (August 31, 1988)	**SWU Value at 0.30% Tails Assay Last Month (July 31, 1988)**	**UF6 Value per kg U as UF6 This Month (August 31, 1988)**	**UF6 Value per kg U asUF6 Last Month (July 31, 1988)**
Australia (dollar)	80.70	84.59	50.90	53.17
Belgium (comm. franc)	2,545	2,649	1,605	1,665
Canada (dollar)	80.38	82.18	50.69	51.66
EEC (ecu)	58.58	60.45	36.95	38.00
Finland (markka)	287.74	299.56	181.49	188.32
France (franc)	411.65	427.14	259.65	268.53
FRG (mark)	121.31	126.75	76.52	79.68
Italy (lira)	90,028	93,638	56,787	58,868
Japan (yen)	8,772	9,002	5,533	5,659
Netherlands (guilder)	136.96	143.13	86.38	89.98
South Africa (rand)	157.88	165.77	99.58	104.21
Spain (peseta)	8,029	8,352	5,064	5,251
Sweden (krona)	418.81	433.95	264.17	272.81
Switzerland (franc)	102.44	105.39	64.61	66.25
UK (pound)	38.48	39.47	24.27	24.81
US (dollar)	65.00	68.00	41.00	42.75

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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RECENT TRANSACTIONS[1]

URANIUM SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4349	1991-95	1,501-3,000	See Remarks	Producer	Utility	Market-Related Pricing
4350	1991-95	1,501-3,000	See Remarks	Producer	Utility	Market-Related Pricing
4357	1988-91	601-1,000	R[3]	Producer	Utility	
4359	1988	101-300	103-107	Intermediary	Utility	
4360	1988	101-300	98-102	Producer	Intermediary	UF_6
4361	1989	50-100	98-102	Intermediary	Utility	
4368	1988	601-1,000	103-107	Intermediary	Utility	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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CURRENT MARKET DATA

LOAN TRANSACTIONS

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Loan Rate	Lender	Borrower	Remarks
4358	1988-89	100-300	R[3]	Intermediary	Intermediary	

CONVERSION SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks
4353	1988	101-300	83-87	Intermediary	Utility	
4366	1988	101-300	123-127	Intermediary	Utility	

ENRICHMENT SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4362	1988	less than 50	113-117	Intermediary	Utility	DOE	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which [illegible]xco is aware.

[2] Where US origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the pre[illegible]um (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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URANIUM SUPPLY
(August 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
87-1002	270	—	1988
87-1068A*	1,000	—	UF_{6e}
87-1123	1,000	1,000 per year	1988
87-1141	500	200 per year	1989-92
88-1000A*	50	—	1988
88-1000B*	200	—	1988, UF_6
88-1001*	200	—	1988
88-1026	250	—	1988
88-1036	100	—	1988
88-1041	680	—	1988, UF_6
88-1078	1,200	—	1988
88-1153*	100	—	1989
88-1155*	750	—	1989, UF_6
88-1157*	1,000	1,000 per year	1989 on
87-1001	—	500 per year	1989 on
87-1005	—	250 per year	1989-95
87-1061*	—	700 per year	1989 on
88-1096A	—	290	1990, UF_{6e}
Total	**7,300**		
INACTIVE			
87-1019	1,000	1,000 per year	1988-91
87-1053	100	500 per year	1989 on
88-1033A	130	—	1988, UF_{6e}
88-1064*	400	400 per year	1988-90
88-1122*	365	—	1988, UF_6
87-1000*	—	1,000 per year	1990-93
87-1130	—	580	1989
Total:	**1,995**		

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 87-1023, 87-1159, 87-1161, 88-1086, 88-1120.

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URANIUM DEMAND

(August 31, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
87-1154A*	44	—	UF_6e
88-1103	250	—	1988
88-1115*	325	—	1988
88-1126*	250	—	1988
88-1133*	200	—	1988
88-1144*	15	—	U_3O_8/UF_6
88-1147*	130	—	1989, UF_6
88-1148*	45	—	1988, UF_6
88-1149A*	45	—	1989, UF_6e
88-1151*	100	—	1988, UF_6
88-1154*	150	—	1988, UF_6
88-1156*	20	—	1988
87-1134	—	260	1989
88-1089	—	1,200 per year	1990-95
88-1107A	—	100	1989, UF_6e
Total:	**1,574**		
INACTIVE			
88-1084	500	—	1988
Total	**500**		

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* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 87-1163, 87-1172, 88-1035A, 88-1062, 88-1083, 88-1094, 88-1106.

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LOAN SUPPLY AND DEMAND
(August 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan: **ACTIVE**			
87-1012	1,000	—	
87-1157	4,000	—	
88-1057	600	—	
88-1135*	200	—	
88-1139*	150	—	
Total:	**5,950**		
INACTIVE			
87-1031	1,000	—	
87-1033	1,000	—	
Total:	**2,000**		

Available to Borrow:

No inquiries to borrow are reported.

* New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: None

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(August 31, 1988)

	Delivery Period[1] (Thousands of Pounds U as UF_6)		
Nuexco Project Number	**Within 3 Years**	**Beyond 3 Years**	**Remarks**
Available for Sale			
ACTIVE			
No active conversion supply is reported this month.			
INACTIVE			
87-1008	770	475	1988
Total:	**770**		
Inquiries to Purchase			
ACTIVE			
88-1034*	110	5,000	1989-2000
88-1113*	250	—	1989
88-1127*	40	—	1988
88-1158*	500	5,000	1989-93
Total:	**900**		
INACTIVE			
88-1021	65	—	
Total:	**65**		

* New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 88-1059 and 88-1098.

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SWU SUPPLY AND DEMAND
(August 31, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
87-1058	20	—	
87-1068B*	250	—	UF$_6$e
88-1065	500[3]	500	1990, UF$_6$e
88-1096B		55	1990, UF$_6$e
Total	**770**		
INACTIVE			
87-1128	360	—	1988
88-1033B	15	—	UF$_6$e
88-1082	25	—	1988
Total:	**400**		
Inquiries to Purchase ACTIVE			
87-1154B*	10	—	UF$_6$e
88-1085	10	—	1988
88-1149B*	15	—	1989, UF$_6$e
88-1107B*	60	—	1989, UF$_6$e
88-1077[4]	—	70	1989-91
Total:	**95**		
INACTIVE			
None reported			

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

[3] SWU supply now estimated to fall within the near-term time frame.

[4] Transaction pending.

Projects removed since last month: 87-1004, 88-1035B.

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NAMIBIA

Tentative Accord Reached on Namibian Independence

The territory of Namibia (formerly South West Africa) (Figure 1), which has been ruled by the Republic of South Africa for more than seventy years, could become politically independent by June 1989, according to a peace plan agreed to in principle by the governments of South Africa, Angola, and Cuba. If the treaty now under negotiation takes effect and a new Namibian government is formed democratically, Namibia's important uranium mining company, Rössing Uranium Limited (RUL) (Table 1), is likely to become a highly competitive U_3O_8 supplier in the international market. Until now, RUL's marketing efforts — particularly in North America and northern Europe — have been substantially hindered by Namibia's political association with South Africa. RUL produced over nine million pounds of U_3O_8 in 1987, making Rössing the world's second largest producing uranium mine and Namibia the fifth largest uranium producing country in the world (Table 2). (See NUEXCO Report Numbers 188 and 189 on the Rössing Project.)

Table 1
BENEFICIAL OWNERSHIP OF ROSSING URANIUM LTD.

Company	Country	Percent Share
The RTZ Corporation[1]	UK	41.4
Industrial Development Corp.	South Africa	10.0
Total Compagnie Miniere	France	10.0
Rio Algom Ltd.[1]	Canada	10.0
Urangesellschaft mbH	FRG	5.0
Capricorn Trust[2]	Namibia	3.4
General Mining Corp.	South Africa	2.3
Undisclosed		17.9
		100.0

[1] RTZ owns 51.3 percent of Rio Algom, so RTZ's net beneficial interest in Rössing is 46.5 percent.

[2] The Capricorn Trust is a private trust established to keep and manage shares in Rossing for the people of Namibia. The trustees are two professional persons from the Namibian capital, Windhoek. The shares were transferred to the Trust by the South African-controlled government in 1987 in accordance with the government's policy not to be involved in private mining ventures. Dividend income is used for educational and other purposes for the benefit of the Namibian people. The Capricorn Trust is represented on RUL's Board of Directors.

The tentative accord on Namibian independence agreed to in early August by South Africa, Angola, and Cuba contains the following key provisions:

- South Africa, which has been supporting the Angolan rebel group UNITA (National Union for the Total Independence of Angola) and attacking the Namibian insurgent group SWAPO (South West Africa People's Organization) in southern Angola, was to withdraw from Angola by September 1. By that date, Angola and Cuba were to present an acceptable schedule for the withdrawal of Cuban forces from Angola. With an estimated 54,000 troops, Cuba has been supporting the communist Angolan government in its efforts to defeat UNITA and assist SWAPO.
- South Africa will withdraw the estimated 50,000 troops it now has positioned in Namibia by February 1, 1989. The South African military presence in Namibia will be replaced by a United Nations (UN) peacekeeping contingent of 7,500 soldiers.

Table 2
WORLD URANIUM PRODUCTION IN 1986 AND 1987
(Millions of Pounds U_3O_8)

Country	1986	1987	Percent Change
Australia	10.8	9.8	- 9.3
Canada	30.5	32.3	+ 5.9
France	8.5	8.6	+ 1.2
Gabon	2.2	2.1	- 4.5
Namibia	9.1	9.2	+ 1.1
Niger	8.2	7.8	- 4.9
South Africa	12.0	10.3	-14.2
United States	13.9	12.5	-10.1
Other[1]	2.1	2.3	+ 9.5
TOTAL	**97.3**	**94.9**	**- 2.5**

[1] Includes Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, and Yugoslavia.

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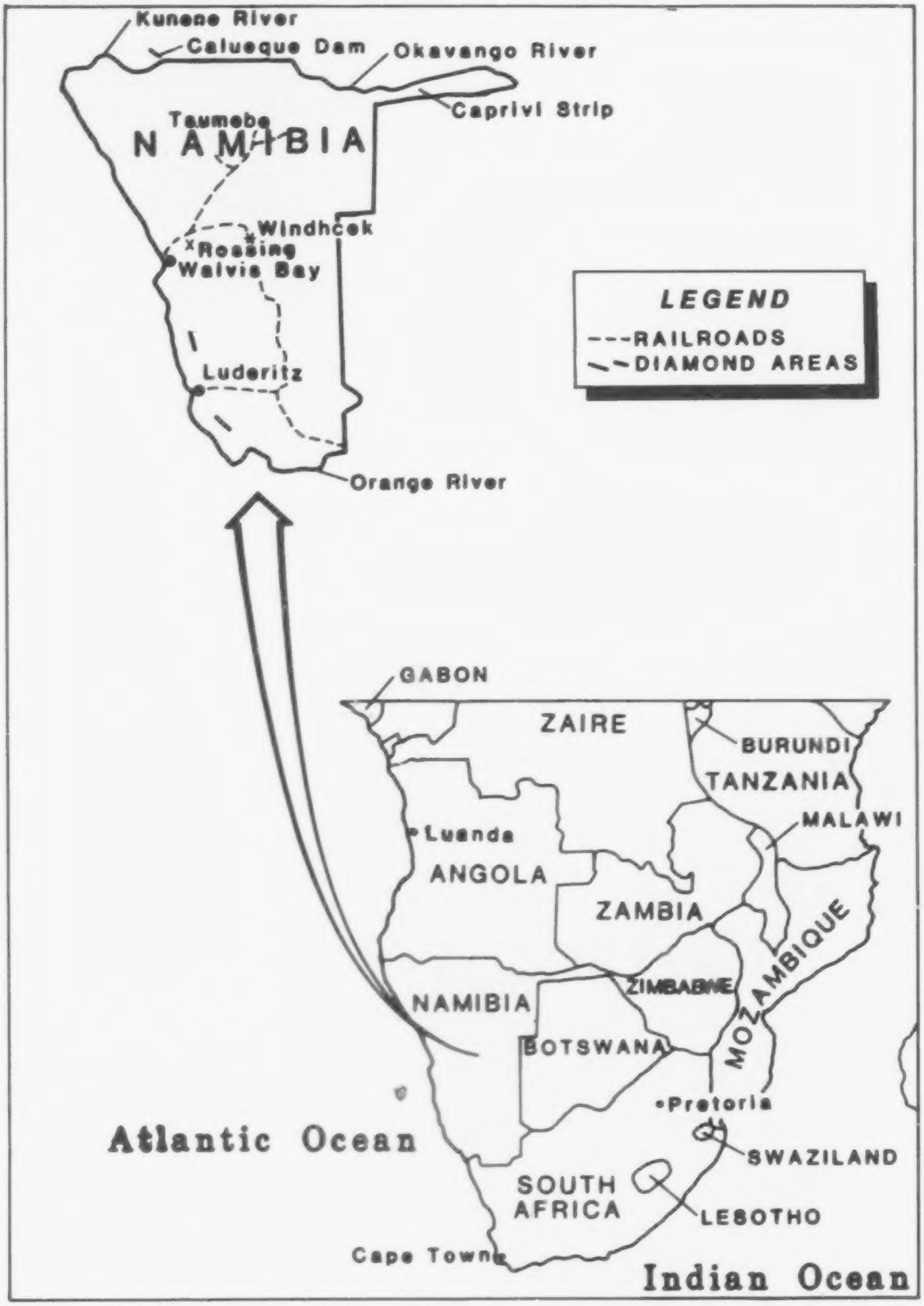
Kunene River
Calueque Dam
Okavango River
Caprivi Strip
Tsumeb
NAMIBIA
Windhoek
Rossing
Walvis Bay
Luderitz
Orange River
LEGEND
---RAILROADS
DIAMOND AREAS
GABON
ZAIRE
BURUNDI
TANZANIA
MALAWI
Luanda
ANGOLA
ZAMBIA
MOZAMBIQUE
ZIMBABWE
NAMIBIA
BOTSWANA
Pretoria
SWAZILAND
Atlantic Ocean
SOUTH AFRICA
LESOTHO
Cape Town
Indian Ocean

Figure 1. Map of southern Africa showing location of Rossing mine, Namibia.

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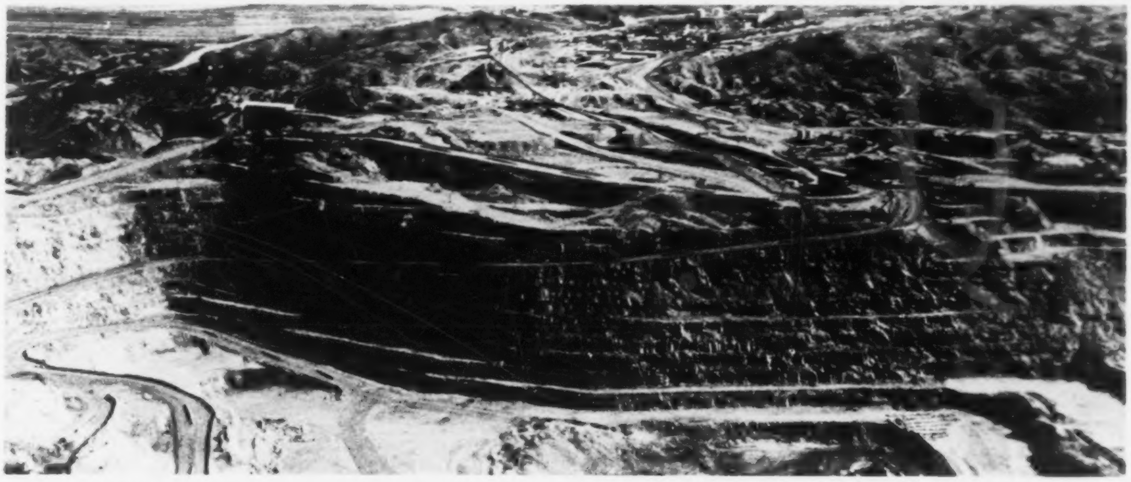

Figure 2. The Rossing open-pit mine. *(Photo courtesy of The RTZ Corporation.)*

- The United Nations will take responsibility for implementing Resolution 435 (1978) of the UN Security Council, which calls for political independence and democratic elections in Namibia.

All sides in the current negotiations appear to be highly interested in the conclusion of a treaty. The current momentum in the peace negotiations began early this summer after a massive buildup of Cuban and South African military forces in southern Angola (Figure 1). Opposing combat units have been situated within ten kilometers of each other at some points near the border. In June, following a Cuban air attack on the South African-held Calueque Dam in which eleven South African soldiers were killed, the South African government ordered all its troops to withdraw south of the border, a tactical retreat signaling South Africa's desire to avoid heavy fighting. Clearly the imminence of a relatively serious conventional war prompted all sides to reevaluate their strategic interests, and it should continue to provide the impetus toward signature of a treaty. However, while the general principles of a settlement have been agreed to, a number of difficult issues surrounding the guerilla movements in the region remain unresolved and may delay the achievement of Namibian autonomy.

In a statement issued June 2, 1988 to the RTZ Corporation's Annual General Meeting in London, the Chairman of RTZ, Sir Alistair Frame, commented on Namibian independence and the importance of Rössing. (RTZ is the largest shareholder in RUL.)

"(RTZ) believes Namibia's best interests, and those of all Namibians, would be served if all concerned could speedily achieve an internationally recognized and accepted independence through which Namibians as a whole can decide for themselves the future of their country. . . Rössing is steadfastly opposed to racial discrimination in the workplace and the community as a whole. . . Rössing's practical example is a model to be followed by those organizations and people who wish to be part of the emergent Namibia. . .The company contributes more than R400 million (approximmately US $235 million) a year to the Namibian economy by way of salaries, purchases of goods and services locally, and corporate taxes. It accounts for almost 20 percent of Namibia's Gross Domestic Product and approaches 40 percent of Namiba's exports." (Greater than 90 percent of Namibia's 1.2 million people are black; per capita Gross Domestic Product (GDP), at US $1,250, is one of the highest in Africa.)

RTZ, which originally owned 100 percent of RUL, took the decision to develop Rössing in August 1973 following several years of geologic studies, at a time of heavy investment internationally in nuclear energy. Mining and mill construction began in 1974; the first concentrates were produced in mid-1976. By 1979, Rössing's output had reached nearly ten million pounds U_3O_8 per year. The open-pit mine (Figure 2), located in the Namib Desert about 70 kilometers from the Atlantic coast, is the largest uranium mine in the world, measured by earth movement, with an output of over 40,000 metric tons of ore and 100,000 metric tons of waste per day. Rössing's reserves are sufficient for continued production well into the next century. ■

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A HISTORICAL PERSPECTIVE ON NUEXCO

Conversations with George White and Bob Wolcott

In commemoration of NUEXCO's twentieth anniversary, we talked with one of NUEXCO's founders, Mr. George White, and an early director of the company, Mr. J. Robert (Bob) Wolcott, about the early days of the uranium industry and NUEXCO's formation and subsequent evolution.

After receiving a degree in chemical engineering from Princeton University, Mr. White was employed by Shell Oil and other companies, and served as Executive Vice President of Vitro Corporation of America from 1948 until 1956 when he joined General Electric (GE) as General Manager of the Atomic Power Equipment Department. There his assigned mission was to manage GE's entrance into the commercial nuclear power business. In 1968, Mr. White founded NUEXCO together with Mr. A. Payne Kibbe (now deceased), and served as its President through 1976. Mr. White was chairman of NUEXCO's Executive Committee until March 1982, and Chairman of the Board until his retirement in October 1982. He currently resides in Pebble Beach, California.

Bob Wolcott, former President (1977-82) and Chairman (1983-85) of NUEXCO, is also a GE alumnus, having spent twenty years with that company. He was the Design Manager for the Dresden 1 nuclear power station — GE's first commercial venture in nuclear power. He also held senior management positions in manufacturing and international areas of GE's nuclear business. In 1968, Mr. Wolcott left GE to establish his own consulting business before joining NUEXCO in 1977. Currently, he is Chairman of the Concord/NUEXCO International Advisory Committee.

George White

Bob Wolcott

NUEXCO: I'd like to go back to the beginning, when NUEXCO was just an idea. How did it all start?

GW: Well, there are two different threads that come together here. First, I was working for GE as the head of their commercial nuclear power business. By 1967, things had gotten pretty tough and, for a number of reasons, we were losing money on our jobs. There was rampant inflation and the start of the anti-nuclear movement, which made our plants more difficult and more expensive to build. The net result was that the general management of GE was not as aggressive toward nuclear development as they had been earlier.

So then I started thinking about doing some other things, one of which was to go into the uranium business in some form or other, because I had previously been president of a uranium company [while with Vitro] in Salt Lake City. In late 1967, while on a plane going to New York for a business meeting, I started thinking about setting up a uranium brokerage business, and I sketched out a little business plan. Using the predictions we had at that time about the growth of nuclear power in the country, I figured out what the requirements for uranium would be, and it was apparent that it was a growth business. I started talking about it with a fellow named Payne Kibbe, whom I'd known on and off over the years and who was interested in that sort of thing.

NUEXCO: Were there any uranium brokerage firms in existence then?

GW: No, definitely not. At that time I was, in my capacity at GE, occasionally buying uranium for some of our customers when they would ask for help. In those days, you could try to buy so many thousands of pounds of uranium, and one day you might pay eight dollars a pound for it and the

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next day you might pay six dollars or seven. There was no standard at all — it was just a free-for-all negotiating thing — and it struck me that there was a place for somebody to come in there — be a trader — and establish a market.

About this same time, (and unbeknownst to me), Payne, who had been president of a uranium company [Atlas Corporation] and was very interested in the financial side of the uranium business, had an idea about setting up a company which would trade in uranium, but not as a broker. He envisaged it as a bank where people who had overpurchased could deposit their uranium, and people who had underpurchased could borrow it, paying interest to the bank. The bank in turn would pay some interest to the depositors.

He and a couple of his associates were preparing to incorporate such a company in, I think it was, March or April of 1968. Shortly thereafter, Payne and I got together and I told him I was going to leave GE. He said, "Well, I've got this idea for a company, but I haven't done anything about it yet. Would you like to come in and we'll put it together on a 50-50 basis?" I said, "Yes, I would", and we did. He said that he didn't think that there was room for brokerage — the industry didn't like middlemen — and so we would incorporate as the Nuclear Bank Corporation, and we wouldn't talk brokerage.

NUEXCO: Was that the name you started with, then? Nuclear Bank Corporation?

GW: Yes, but as Payne tried to incorporate it he found that anything with the name "bank" in it was subject to various state and federal rules and regulations, so it was quickly changed to Nuclear Exchange Corporation. The shortening to NUEXCO came from my wife — she always called it NUEXCO — and we eventually adopted that name.

NUEXCO: How did Bob Wolcott become involved with NUEXCO?

GW: We were looking for another director and I proposed to Payne that we put Bob on the Board. I'd worked with Bob since 1948. He resigned [from GE] a few months before I did to set up his own consulting company.

NUEXCO: Mr. Wolcott, when you were with GE, did you know Payne Kibbe?

BW: No, but I got to know him real well after I became one of the directors of NUEXCO. As I remember, George and Payne were the founders, and Payne appointed two of the directors: Mike Romney and Don Allen from Salt Lake City. I was one of George's appointees from the local [California] scene, if you will. George's other director was Jules Pearlman. So we had a six-man board — George, Payne, Mike Romney, Don Allen, Jules Pearlman, and me.

NUEXCO: When you first were involved with NUEXCO twenty years ago, how did you perceive the future?

BW: We all thought it was going to have a bright future. At the time when we first started in the [commercial] nuclear business, which was 1955, the US growth rate for electric power was seven percent per year, and had been that rate for fifty years, which meant that the whole generating industry doubled every ten years. With that kind of projection we could see that there was a tremendous need for new power generation of all kinds. And at that time, the environmentalists were not a strong force. In fact, the environmentalists thought nuclear power was great — no ashes, it didn't spew a lot of stuff into the air — so we had very good support there. Utilities didn't like coal. But the key at the time was to get nuclear power to be economically competitive with fossil fuels. That was the challenge that we really had to struggle with, because it wasn't that easy to get nuclear power costs down to the same level as oil and gas.

That was the single biggest event that turned on nuclear power — when its costs dropped to be competitive with fossil fuels. In fact, looking back, I guess that was the thing that really got NUEXCO going, because there was, in the early 1970s, a burst of orders for new [nuclear] power plants, and a tremendous concern over how they were going to be fueled, and people rushed out to cover their future commiments with long-term contracts. So there was a flurry of activity in the uranium industry that was far beyond anything that had occurred previously.

NUEXCO: In the early years, how did a nuclear utility go about buying uranium for its plants and getting it fabricated?

GW: Well, you take some of the earliest nuclear utilities, like Commonwealth Edison in Chicago. They would buy a nuclear plant from, say, GE, which probably included the fabrication of the first core and several reloads, then they would go out and buy the uranium and the conversion to UF6. In those days, they would buy the enrichment, of course, from the AEC. When they bought the uranium, the utilities would usually go out for sealed bids. They would advertise or they would just write all the uranium producers asking for their best offer for so many pounds delivered at such and such a place, on such and such a date.

When we first started NUEXCO, Payne and I — I guess myself more than Payne — travelled to all the utilities that were interested in nuclear, and proposed that they join the Exchange. They would have the privilege of getting our reports and they would have the privilege of depositing and borrowing, and so forth.

NUEXCO: Did they respond favorably to that?

GW: No. Mostly we were told that they were very smart people. They said, "We are very competent managers, and we don't plan to buy either too much or too little uranium. We are going to buy just the right amount." We would say, "Well, things don't always work out quite the way you expect them to. Sometimes you have fuel failures and you have to have a replacement, or something else goes wrong. It's pretty hard to believe that you can be that accurate."

What we did, finally, was to convince a fellow named Bill Webster of New England Electric [to join]. He said he would join for a year, and he would use his best efforts with the Edison Electric Institute to see that we got enough subscribers to make us viable, and he was as good as his word. We got ten or twelve utilities, which at that time was pretty good.

NUEXCO: Was that enough to make the business start up and go?

GW: Oh, it paid the rent and a few other things. I guess it was almost a year before we made our first transaction, which was when Cotter Corporation [now a wholly-owned subsidiary of Commonwealth Edison] borrowed a hundred thousand pounds of uranium — at least that's my recollection. I think they borrowed it from a US utility that had too much on hand. It was a deal something like that, and that was very exciting.

Then something came to pass which really was the most important aspect of all of this. And that was, in signing a contract, the borrower had to agree to pay back the same amount that he borrowed. But here again, you can never return the exact same number of pounds you borrowed — you'd be a drum heavy or a drum light and there might be as much as a thousand pounds of uranium more or less than you'd borrowed. And what was that worth?

So we established an "Exchange Value". We did that very early in the game to reflect our view of the market. And, of course, that was what made NUEXCO go, because before long everybody wanted to know what the Exchange Value was for the next month, and so they all started subscribing. And first thing you know, somebody said, "Look, you know what's going on, we need a million pounds of uranium next year — why don't you buy it for us and we'll pay you a little bit to do it." An then, of course, the brokerage end of the thing completely swamped the lending/borrowing end. That's how we got from there to here. We really developed the brokerage end of it.

NUEXCO: How do you think the industry viewed NUEXCO setting up as a brokerage house?

BW: It was not the original intent of the company to be a brokerage operation and, for a long time, Payne was very much opposed to calling it a brokerage operation or identifying the people [NUEXCO] as brokers. He was interested in calling them almost anything but brokers because he said, "If you go to a utility and say, 'I'm a broker', you won't get through the door." But the business emerged into brokerage without being called a brokerage operation. It was still developing as a bank, but then opportunities came along to sell uranium or buy uranium.

NUEXCO: So utilities didn't like brokers?

BW: No, the utilities didn't like brokers.

GW: Well, it's not until you become a broker that you realize how much work there is in putting a deal together. You're saving a utility a hell of a lot of money, really. Some of them understand that and some of them don't.

NUEXCO: How about the uranium producers?

GW: They didn't like it to start with. But when they realized that they were getting whipsawed by the utilities they started thinking maybe it wasn't such a bad idea. Of course, that varied. Some liked us and some didn't.

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NUEXCO: Do you think the industry was ready for brokerage at that point?

BW: I would say it must have been. The greatest test of whether something is really needed is whether the market supports its. And the market did support it. NUEXCO really caught on.

NUEXCO: What was Payne Kibbe's involvement in the growth of the company?

GW: Well, we agreed that I would run the operation but that he would feed information to me and we would work together on the business end of it. He was a consultant and he got around a great deal. And, actually, many people have said to me over the course of the years, "George, why did Payne get half of everything here? You're the guy that did all the work." My answer to them was, "Maybe I can't describe quite what Payne did for me, but I can tell you that we wouldn't have a company if it weren't for him."

I guess you really have to have at least two people to make anything go right. There are loners, but I'm not one of them. I was on the phone with him at least once a day. We discussed every move we made, and he was very, very important to me — a wonderful friend and partner. Furthermore, I was well connected mainly with the utility industry, and he was well connected mainly with the uranium industry. Both sides have always been equally important to NUEXCO.

NUEXCO: What were the deals like at first? When did they become more complex?

GW: One of the earliest large contracts we had was with a company who was a very large factor in the business then. The buyer that was responsible for their uranium business called me up and he said, "You say your Exchange Value is six dollars?" (It was in that range.) "We can't produce uranium for six dollars. You're just fooling the whole world."

And I said, "No, if you want us to buy uranium for you at six dollars, just give me an order."

He thought for a while, and he said, "I'll tell you what I'll do. I want my name kept completely out of this thing, but I'll set up so many million dollars in a bank account and I want you to buy for me," I think it was, "three million pounds of uranium, and I'll pay you, maybe, a nickle a pound for it, and you can buy all that at your price of six dollars or less."

I said, "Fine".

And he added, "The only thing is, I'm not going to give you a checkbook with 18 million dollars in your name, so we've got to set up some kind of escrow agreement with a bank."

This turned into a fairly complicated thing, but we bought all this uranium for him. That was the first big use of a broker. And then people started to come to us because they saw we were, in fact, doing business.

Another one of the early deals involved United Nuclear. They needed to borrow a lot of money to open up a new mine or something, and they were having trouble raising the money. And so we said to them, "Look, we know a utility that has several million extra pounds of uranium because their plants have been badly delayed. Why don't you borrow that from them, you can sell it, and you'll get your cash. And the utility will be delighted to lend you that at maybe three or four percent interest, whereas you'd have to pay the bank ten."

Well, they [United Nuclear] thought that was a great idea, and the utility liked it because it got that material off their backs and gave them a little income. United Nuclear was then one of the big producers and the utility felt very confident that there was no problem about getting paid back. This transaction got more complicated because, in addition to arranging the loan, NUEXCO was selling the material for United Nuclear. That would have been about 1973 or 1974. I can remember sitting in a hotel in San Francisco, putting that deal together on the back of an envelope with United Nuclear's treasurer.

Then there were people who had uranium that had already been converted to UF_6, so then you had to work out a scheme to equate UF_6 with U_3O_8. To complicate it further, some people had partially-enriched uranium, so then you had the opportunity of de-enriching and deconverting. These things came about because of the inequities — the imbalances — which Payne and I had foreseen when we started, but they were far more complicated than we'd ever anticipated, and that was better for us.

BW: Part of our strategy was to participate in the more complicated deals, and to leave the simple little deals to the competitors, because we had a worldwide complex and we had more talent working together. We were trying to move into the part of the market where things were more

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complicated and where the value of services was much higher. This is what NUEXCO has continued to do. It's moved up the scale, and by adding in the capability to arrange financing, it has significantly enlarged the services that are provided.

NUEXCO: Was NUEXCO doing long-term contracts as well as spot?

BW: Yes, all kinds. Initially it was more spot brokerage, then it began to get more into long-term contracts as well as spot brokerage. Then after the big price collapse, a major portion of our business was selling off excess inventories held by utilities. Much of this uranium was purchased by producers who had long-term contracts, and who could buy the material more cheaply than they could produce it from their own mines. So we had, at that time, what we called the "upside down market", where most of the deals were from utilities to producers.

NUEXCO: How many brokers did the company have at that point?

BW: Let's see. When I became President of NUEXCO we had Sandy Anderson, George White, Jr., Jim Vaughan, Wayne Fowler, Jerry Reaves, Tom Boyden, Wes Miller, and Lanny Phillips. That was about the total organization — that would have been in 1977. Then we started building up by adding young people. We added a round of young people, that must have been in the late 70s to early 1980s. They included Katie Bowen, Kim Peyton, Scott Hickman, Terry Elms, and Michele Patin.

NUEXCO: Was NUEXCO doing consulting then, too, or was it almost entirely brokerage?

BW: We were doing some consulting, but very little. It was nearly all brokerage.

NUEXCO: During the first few years, was the government apprehensive about the Exchange Value?

GW: I don't think so. At the very beginning, I don't think they took us very seriously — well, nobody did. You know how it is when you're just getting started. But later — I was very well known, having been head of the GE organization, and Payne was well-known by the producers — I think we had the basic confidence of the government people.

NUEXCO: How did people respond to brokers also establishing pricing indicators? Did you run into the situation early on, where people were concerned about a potential conflict of interest?

GW: Oh, yes we did — all the way through.

BW: Naturally, the utilities thought it was high, and the producers thought it was low. But this seemed to me to be natural. I was not unduly concerned about that. We did do one thing because of these comments — we added the Transaction Value. The idea was that, we've got this one value — the Exchange Value — which is a matter of judgment; it's on the leading edge of prices. No, let's add something that's more analytical, that has less judgment in it and trails along based on history, and you can use that as a check on the Exchange Value.

I used to say, "Look, we publish the [Exchange] Value, but how you use it or whether you use it is entirely your business. You're not obligated to do anything with it merely because we publish it. If you want to use somebody else, fine. If you want to use it in a contract, that's your business. We're not urging you to put it in your contract."

I think the Exchange Value did a lot to establish the identification of the name NUEXCO, because people did begin to accept it as an accurate measure of spot market prices.

NUEXCO: When did you begin sending out the first Monthly Reports with the Exchange Value information? Was that from the start?

GW: Yes. The first one — well, I'm embarassed when I look at it — it was really a rudimentary thing, but I managed to get it a little bit better and, in 1970, we hired a fellow named Jack Mommsen. One of the first things that Jack insisted on was that he be given free rein to give us a decent Report. He said, "I'm ashamed of that".

Well, I was so wrapped up in the mechanics of the business and worrying about the money that I wasn't paying enought attention to it, and he had just completed his MBA and had specialized in marketing. That was one of the great things that happened to us — having Jack run the Report.

NUEXCO: Was the Monthly Report a good part of your business at first?

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GW: It was the thing that kept us alive. We built the subscription list, as I recall, to over 400 quite rapidly. It really took off.

NUEXCO: How much did you charge for a subscription?

GW: Well, it was originally a hundred dollars a month if you were a producer or a utility. But Wall Street firms subscribed to it, and they had a special rate. And the federal government — the AEC — finally gave us a bunch of subscriptions to it. We gave them a special rate on that because we wanted to see it around on their desks. And then the foreign people started to get interested in it, and we started to get subscriptions from them.

NUEXCO: What was the uranium market like back in the late 1960s?

BW: Uranium prices were all over the map. The industry was pretty wild, because back at the start the utilities weren't allowed to import uranium. So they all had to buy domestic uranium — one hundred per cent through 1976 — and then it phased down to no import limit. But the whole nuclear business was taking off with a roar, and the big concern was being sure that you had an adequate fuel supply. I can remember that some public utility commissions wouldn't permit the utilities to buy a reactor until they had assured the PUC that they had contracted for an adequate supply of uranium. So there was tremendous pressure on the domestic uranium industry. Then the whole nuclear business went to pot, and the access to foreign uranium opened up, and that reversal really created a chaotic situation for the uranium producers here in the USA.

NUEXCO: So could the utilities drive a pretty hard bargain, or was the market being driven by the producers?

BW: The utilities drove a hard bargain until the industry took off, that is, until the [plant] orders started rolling in. Prior to 1970, there was really very little demand for uranium. There were only a few reactors operating.

Beginning in the 1970s, the projected demand for uranium was tremendous and, of course, US utilities could only buy US uranium. That put a constraint on it, and the price really shot up then. And when the price shot up, that convinced everybody that there must have been some kind of price fixing, and the lawsuits started and the great anti-trust investigation got underway. But I don't think price fixing had anything to do with the price increase.

NUEXCO: That was in about 1973 or 1974, if I remember, when that price curve started going upward.

BW: I came to NUEXCO in January of 1977, and the anti-trust investigation was underway at that time. The whole anti-trust investigation must have started in 1976, but the Westinghouse affair started in 1975.

GW: One of the things that was the most traumatic to me was when Westinghouse overcommitted. They went short on the market and, of course, it drove the price up to — what was it — over forty dollars a pound as I recall. We had a terrible time trying to decide what the Exchange Value was going to be from month to month because it would move three, four, five dollars a month, and everybody was mad at us then. The producers thought it should be even higher, and the utilities would call up and just scream at us, that we were just burglars, that we didn't understand our business. But in hindsight, I'd say that we did it about right. Then, of course, following the Westinghouse case, came the anti-trust investigation.

NUEXCO: Did they subpoena you?

GW: Yes. I spent close to a week in Washington in front of a federal grand jury, as did my son, George. You know, that sort of thing is terribly expensive and I think the whole thing was outrageous.

NUEXCO: Why did Westinghouse get in trouble and not GE?

GW: Because GE didn't sell short. During that period, I was running GE. Westinghouse was selling plants, and part of their competitive stance was to offer to include cheap uranium. Unfortunately, they neglected to make any arrangements to buy the uranium they'd committed to deliver. They were short. And the sales people [at GE] were really beating on me to do the same thing, and I said, "No, sir." I had been in the uranium business and I didn't want anything to do with speculation in the metals markets.

I used to argue that GE didn't have the people, the constitution, or the ability to withstand the pressure when

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things went wrong. And it will. The market's going to go wrong on you sometime. And that's really what happened to Westinghouse. They panicked.

NUEXCO: Did you have any other run-ins with the government?

GW: I think that's the only one. By and large, they were very supportive. DOE used SWUCO [an affiliated company] a lot more than NUEXCO. They thought SWUCO was great because we helped them with their inflexibility, and we allowed customers to gain flexibility. DOE could see the French and others building enrichment plants, and they were faced with a very difficult problem pricing and contracting and handling their SWUs, because Congress was second-guessing them all the time. We gave them flexibility without them having to give it away, which would have been the case if they'd written their contracts to give that flexibility.

NUEXCO: How would you describe NUEXCO's position in the industry during its early years?

BW: It certainly was well-known in the industry and, I think, gained an early niche in it. It was pretty much domestically oriented, partly because there was a fence around the domestic industry. A lot of what happened during the time I was involved with NUEXCO was that it became much more international. Partly that was because some of those barriers came down — there was more buying and selling — and partly because it was obvious that uranium was such a fungible material and was so easily shipped, that it just had to be treated that way.

NUEXCO: When did NUEXCO begin to take part in the international market?

GW: Rather early. I was interested in becoming more international because it seemed to me that, more than anything else, uranium was an international material, since it was very valuable and could be easily transported. It was in the early 1970s — 1972, I think — that we concluded agreements with Nukem and Marubeni [a Japanese trading company] to represent us in Europe and the Far East.

NUEXCO: When you started dealing with different countries, which countries were the first ones?

BW: I think probably the Europeans, and then we did quite a few deals in Taiwan and in Korea, and some in Japan. We were quite successful in Europe. That is why we established the European office.

Back in 1977, we were all in Menlo Park [California], and we only had ten or eleven full-time employees — it wasn't very big. We grew a little bit, and our first office outside Menlo Park was in New York. Jim Vaughan and Katie Bowen went back to establish that office in late 1981. Then the business in Europe developed a little, but we felt there was more potential if we had some people on the scene. In the fall of 1982, Jim and Katie moved over to Europe from New York.

NUEXCO: What was the next stage, then, for NUEXCO?

GW: It was a little complex. In 1972, the AEC came out with a new form of enrichment contract, a fixed commitment kind of contract. And as soon as I read about that I thought, "Boy, there's a place for brokers", and we formed a company called SWUCO.

Payne and I decided that we would make it a subsidiary of NUEXCO — we would separate the two functions — but we needed some money to get that started. We got some money from Nukem and Marubeni, but SWUCO's funding came mostly from NUEXCO and its shareholders. Initially, it was not a happy arrangement because SWUCO didn't do very well. It kept losing money, and we couldn't seem to make a deal.

But later Walt Wolf hit upon a clever scheme of assigning excess SWUs to utilities and, at the same time, having those same utilities cancel some of their previously committed SWUs at no charge. After he put the first one of these deals together — and it was so successful and everybody made money — we were innundated with business. Of course, Walt then had a lock on the market.

NUEXCO: Why did SWUCO split off and become a separate entity?

GW: The fundamental reason was to allow Walt and SWUCO to focus on the SWU business. Walt was the key to SWUCO's success, and initially we saw SWUs as separate and distinct from NUEXCO's uranium business. That, of course, changed over time.

BW: You know, SWUCO was actually established by George and Payne, but Walt advocated an independent

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SWU business. What we didn't really do — Payne, George, and I — was look far enough down the road. At one time SWUs were over here, and uranium was over there, so we were widely separated in totally separate businesses. But then as you began to build up enriched uranium — there was a big inventory of enriched uranium — who's going to handle the enriched uranium? Well, to us at NUEXCO it didn't make any difference whether the uranium was 0.7 percent U235 or whether it was two percent or five percent. But then, utilities began to change and they began to think more in terms of the total problem. So the utility buying practices began to involve buying SWUs, enriched uranium, natural uranium swapping, and one thing and another, and the businesses got very much intermixed. As it turned out, after the ownership interests of NUEXCO and SWUCO were separated, NUEXCO became extremely active in the SWU market also, and the two companies were in competition with each other.

NUEXCO: Do you have any comments, now that SWUCO and NUEXCO are back in the same hands?

GW: Well, there's more competition in the business now, and it would seem to make sense to have a stronger, integrated organization which can handle all types of transactions.

NUEXCO: Do you have any closing thoughts that you'd like to leave us with?

GW: Well, one other thing I can say. . . Payne and I had a whole lot of ideas for this company. But the thing we really wanted to get into was the financing. We made a number of trips to Wall Street. Both of us were pretty well connected there and, you know, we never were able to swing anything. We just didn't have the financial muscle to do it. But Mr. Benton has added that financial and financing capability which is great.

I ran into a fellow a couple of years ago — an old friend who had been chairman of a US utility — and we were talking about the business, and he was talking about NUEXCO and how he though it was very clever. And I said that I thought I had been very lucky in how things had worked out back then.

And he said, "No, you were in the right place at the right time with the right product, and you can only hit that about once in your life, and you'd better take advantage of it." And you know, I think that's right. Had we started NUEXCO earlier, I don't think it would have flown at all, and if we'd waited much longer I'm sure someone else would have gotten into the act ahead of us. As it was, we had the field really all to ourselves for a long time — it was just amazing.

BW: It's interesting to look back, as we wind up our discussion on the twenty-year history of NUEXCO, which has always adapted to whatever the market required, while at the same time moving the business forward. Those twenty years can be divided, more or less, into three eras.

The first was the period in which George and Payne established the company, shaped it to a market that would support it, and gathered a nucleus of staff.

The second era emphasized building upon the foundation previously established by developing people—especially young people—, expanding the organization and the range of talents and client services, and becoming more international. But it later became apparent that NUEXCO needed a new dimension if it were to develop its full potential.

That dimension was provided when Oren Benton, an entrepreneur, bought the Company, adding creative financial capability, financial resources, and a new spark to the organization. Now in the third era, NUEXCO has the capability to increase what I term "nuclear fuel market liquidity"—NUEXCO can facilitate distribution of nuclear fuel, investments, and commitments more effectively. The way has been opened for more NUEXCO-contributed value to marketplace needs, and, at the same time, for further growth and expansion.

This third era, of course, is not the end. My experience has been that the NUEXCO business planning horizon is only two or three years, so I don't try to look too far ahead. Nevertheless, we can be confident that there will be a fourth era, a fifth era, and more. I do not know what or when the next stage will be, but I am confident that NUEXCO will continue to adapt, prosper, and take another step up the ladder as new needs and opportunities evolve. ■

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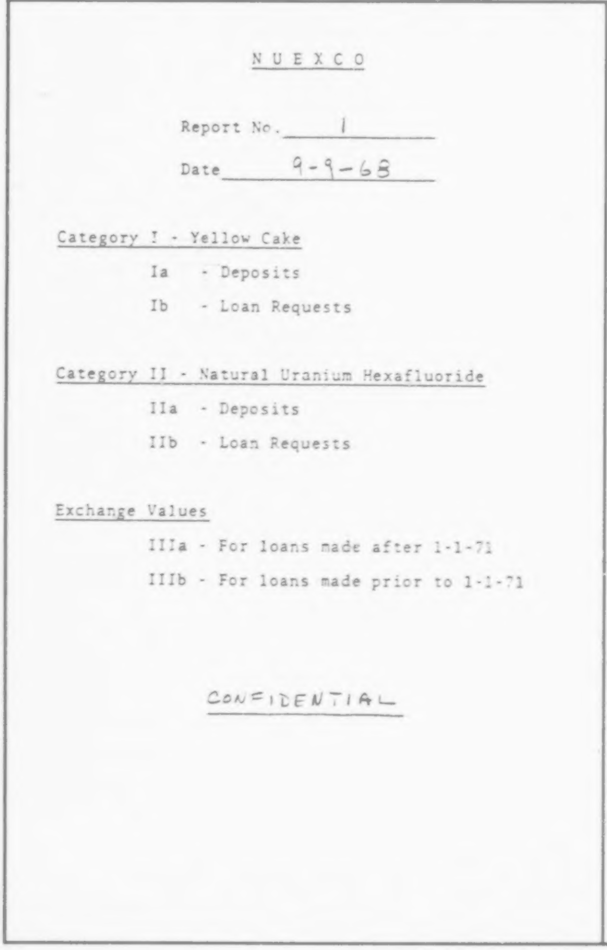
NUEXCO Monthly Report
Number 1
September 1968

Reprinted below is the cover page of the first NUEXCO Monthly Report and page three, the last page of the report, showing market values for September 1968. Yellowcake and UF6 deposits and loan requests were shown on pages one and two of the Report.

Cover Page



NUEXCO

Report No. 1

Date 9-9-68

Category I - Yellow Cake

- Ia - Deposits
- Ib - Loan Requests

Category II - Natural Uranium Hexafluoride

- IIa - Deposits
- IIb - Loan Requests

Exchange Values

- IIIa - For loans made after 1-1-71
- IIIb - For loans made prior to 1-1-71

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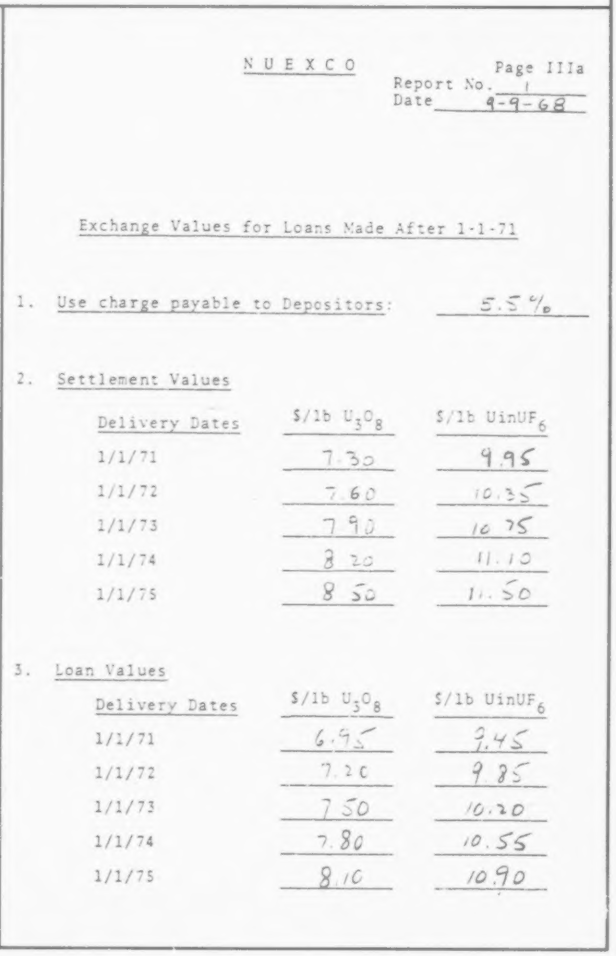
Page Three



NUEXCO

Page IIIa
Report No. 1
Date 9-9-68

Exchange Values for Loans Made After 1-1-71

1. Use charge payable to Depositors: 5.5%

2. Settlement Values

Delivery Dates	$/lb U_3O_8	$/lb UinUF$_6$
1/1/71	7.30	9.95
1/1/72	7.60	10.35
1/1/73	7.90	10.75
1/1/74	8.20	11.10
1/1/75	8.50	11.50

3. Loan Values

Delivery Dates	$/lb U_3O_8	$/lb UinUF$_6$
1/1/71	6.95	9.45
1/1/72	7.20	9.85
1/1/73	7.50	10.20
1/1/74	7.80	10.55
1/1/75	8.10	10.90

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THE BEGINNINGS OF THE URANIUM INDUSTRY — A HISTORY

Introduction

This article presents a brief overview of the uranium industry from uranium's discovery in 1789 until the 1940s. A brief caveat concerning the figures presented here is in order. Many published accounts of this period contain highly conflicting figures regarding uranium ore and concentrate production, uranium prices, and radium output. The figures contained herein are NUEXCO's best estimates.

The Discovery of Uranium

In German they are called the Erzgebirge — the ore mountains — a low range between Germany and Czechoslovakia that for centuries has yielded a rich harvest of diverse metals. Ore found near the village of Sanct Joachimsthal in 1519 was used in the first silver coins which were called Joachimsthaler. Soon, these coins became known simply as "thaler" and by 1600, they had become "dollar" in English.

In 1789, a German apothecary named Martin Klaproth succeeded in isolating a grayish metallic substance from a peculiar ore occasionally found in working the nearby Joachimsthal mine. The ore — heavy, velvety black or brown, brittle in fracture and relatively hard — was found in fissure veins and occurred in sections varying from the thickness of a knife blade to several inches in width. This was pitchblende, later labelled uraninite. To honor the German-born British astronomer Sir William Herschel's discovery eight years earlier of the new planet which Herschel had named Uranus, Klaproth called his metal uranium.

Not long after Klaproth's discovery of uranium, experimenters found that its compounds acted as good coloring agents in ceramic glazes. At concentrations of 0.006 percent, the chemical produced a yellow color and, with successively higher concentrations produced orange, brown, green, and a rich, velvety black that was much prized. The forests surrounding Joachimsthal supported one of the centers of ceramics and glassmaking in Europe, with their plentiful supplies of wood for charcoal, and miners began to collect pitchblende residues on a small scale from slag heaps and from the active workings at the Joachimsthal mine. The ore was rich in uranium, averaging 45 to 50 percent U_3O_8 and occasionally assaying as high as 80 percent.

An Industry Takes Shape

The demand for uranium, though not great, nevertheless attracted the atttention of miners in other countries, and discoveries of small quantities of pitchblende began to be reported in France and in England. In Cornwall, lumps of pitchblende were found in discarded ores from tin mines, and soon after were reported from several operating mines. Throughout much of the second half of the 1800s, the English mines were almost the only competitors to Joachimsthal for supplies of pitchblende, although mines in Saxony and in Hungary also contributed small amounts of ore.

While it is difficult to estimate the actual quantity of pitchblende ores taken from the Joachimsthal mines during the 1800s, the total production of this mineral from Cornish mines has been estimated as approximately 325 long tons between 1856 and 1900. This corresponds to perhaps 150 tons U_3O_8 equivalent. Although quite small by today's standards, this quantity, in combination with the Joachimsthal production which was at least as great as that of the English mines, satisfied the demand for uranium.

As new applications for uranium compounds were found, demand slowly increased. By 1900, uranium salts were used not only in ceramics and glassmaking (see yellow sidebar), but also in photography (uranyl salts are sensitive to light) and in steelmaking, where new alloys containing uranium carbide appeared to offer much promise (see yellow sidebar). Of the uranium being produced in the USA, by 1900 virtually the entire output was exported, chiefly to France, where steelmakers in particular were excited about the potential military uses of "ferro-uranium", as it was called. Uranium was quickly becoming an international commodity.

Discoveries in the USA — Colorado

The earliest reported discovery of uranium in the USA is generally thought to have been in Colorado by Dr. Richard Pearce of Denver. Dr. Pearce reported the finding of pitchblende in the Wood Mine near Central City. Later, pitchblende also was found in other nearby mines. Market conditions at the time were such that the pitchblende ore procured by Pearce glutted the market, and it was not until some years later that he sold much of the original material — entirely in England and France.

The discovery of another uranium-bearing mineral called carnotite proved to be of considerably greater long-term significance.

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Figure 1. An early freight outfit. (Reprinted from *Uranium Country*, 1955, University of Colorado Press.)

Although the yellow mineral was known to have been collected by Indians prior to 1880 (for use in war paints) in La Sal Canyon, Colorado, probably the earliest documented discovery of carnotite can be attributed to Tom Talbert. In 1881, Talbert staked a claim at Roc Creek in the Paradox Valley, but the elements in the mineral discovered were not at that time identified. Talbert's claims were later relocated several times and, in 1898, Gordon Kimball leased the property. According to a letter sent by Kimball in 1904 to the Engineering and Mining Journal:

"In 1897 I met, in Denver, a French chemist named Charles Poulot, who was in the market for ores containing rare metals, especially uranium ores, and through him learned to distinguish the various compounds of that element. I had long been familiar with certain deposits on Roc Creek in the extreme western part of Montrose County, Colorado, that had been located many times for copper values. . . . I learned that quite a large deposit of yellow minerals, called by the owner chrome copper ore, had been exposed in one of these claims several years before. In the spring of 1898, I obtained samples of the "yellow stuff" and sent them to Mr. Poulot who pronounced them uranium ore and gave the mineral the name of autonite or uranochre.

. . . In June 1899, I mined ten tons of ore (practically all from one pocket), sacked and packed it in burros across the mesa to Paradox Valley, a distance of twelve miles. From there it was shipped 80 miles by wagon to Placerville, and thence to Denver by rail where it was sampled and sold for $2,600, or at the rate of $12.50 per unit. The entire lot averaged 21.5 percent oxide contents. This ore also carried over fifteen percent vanadium, for which our purchasers in France, on resampling the shipment, exacted a penalty instead of allowing value. . . It is not improbable that it was one of these specimens which, on analysis, was found to contain radium, and was named after the eminent scientist, M. Adolphe Carnot."

As word spread that the uranium mineral was marketable, other discoveries also were reported, although not as quickly commercialized as the one at Roc Creek. In 1898, a discovery was reported in Grand County, Utah, just southeast of the Colorado River. In 1899, Ike Hallet noted a carnotite vein about two miles north of the present-day town of Uravan, Colorado at the Salt Lick claim. The same year, the mineral was found in the McIntyre (Dolores) River canyon and some carnotite ore was mined from the Yellow Bird Mine in La Sal Canyon. In 1900, sheepherders found uranium and vanadium mineralization in the Green River district of Utah.

Mr. Poulot and a colleague began experimental work with the new ore, and in late 1899 or early 1900 formed a new company to deal in uranium. After shipping several loads of crudely concentrated uranium-vanadium ore to France, Poulot built an experimental three-stage mill near the Slick Rock area. The mill reportedly had a ten-ton Krupp ball mill, three leaching tanks of about ten-foot diameter, and

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Table 1
URANIUM ORE GRADES IN COLORADO IN THE YEAR 1900

Quantity (lbs ore)	Grade (Percent)	Percent of Total Ore Mined
16,650*	15-16	5.4
90,000	10	29.3
60,000	6	19.6
140,000	5	45.7

* Includes some pitchblende ore mined in Gilpin County.

upright boiler and three tall precipitation tanks. By one account, the mill cost about $8,000 and processed altogether about 355 tons of carnotite ore, yielding some 15,000 pounds of uranium oxide before work was discontinued in 1901. Several other companies operated the mill briefly over the next few years.

Market Conditions at the Turn of the Century

Although the market for uranium around the turn of the century was limited, the relatively high prices paid for ore stimulated considerable interest from inquisitive prospectors and mineral speculators. In 1900, carnotite ore having approximately ten-percent U_3O_8 content could be sold in Denver for between $500 and $550 per ton, and partially-processed concentrates were worth between $2.25 and $4.00 per pound. Ore production in Colorado rose from about seventeen tons in 1897 to 33 tons in 1898 to 43 tons in 1899. According to official statistics, by 1900 production had surged to 153 tons of uranium ore. By contrast, production of pitchblende ores in England measured seven long tones (2,240 pounds) in 1899 and 41 tons in 1900, and Austrian output of uranium ores (pitchblende from the Joachimsthal mines) probably was between 10 and 30 long tons respectively in 1899 and 1900.

Although the average grade of the carnotite ore was generally lower that that of pitchblende, it was available in vastly larger quantities and was accessible by surface mining. (Carnotite has a distinctive canary-yellow color, and generally occurs layered in sandstone.) Of equal or greater importance to miners of the day, carnotite contained significant amounts of vanadium, which was gaining in demand as a steel alloying mineral and as a coloring agent for the dying of silks.

For the first few years, the carnotite ore removed from the Paradox Valley and other nearby areas was of high grade. Some of this ore contained 15- to 20-percent uranium and occasionally a shipment might run as high as 45-percent uranium. Since the ore had to be packed into bags and freighted in wagons some 40 to 70 miles to the nearest railhead, it was carefully hand sorted and only the better grades were deemed worthy of handling. In part, this reflected the attitude of European buyers who represented the market and who, for a number of years, were not interested in any ores with less than three to five percent U_3O_8 content. Also, production costs had to include freight from a remote valley in eastern Colorado to the east coast of the USA, and then transshipment to Europe.

Until perhaps 1902, there was little digging underground for uranium ores; the limited demand could be met by carefully following known surface deposits and picking out the richest specimens. Table 1 shows the range of ore grades mined in Colorado during 1900.

By 1903, the steadily increasing production from Colorado had had its effect in Europe. The last remaining pitchblende source in England, the mined-out South Terras property in Cornwall, ceased production of uranium in 1902. (A decade later it was revived when market conditions brought new demand.) It appears that pitchblende output at Joachimsthal also was considerably curtailed. A new market for uranium ores, however, was about to open up, transforming the tiny uranium industry and making uranium a subject of everyday conversation in many areas of the world. That new market was to become known by one word — radium.

"Radium completely neutralizes the poison of the viper, on 50 to 60 hours exposure." (E&MJ, April 1905)

The Most Expensive Substance in the World

More than a decade elapsed between the discovery of radium in 1898 by Marie and Pierre Curie and the

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development of an efficient, commercially-viable process to extract it. During this period, a wide variety of claims were made about radium's miraculous properties, and a great deal of public attention was paid to a substance which, as yet, had little practical use.

In the mining industry, radium's newfound status focused renewed attention on uranium, although for several years after 1900 it was not clear how, or if radium was connected to uranium. While the earliest samples of the new element had come from processing uranium ores, it was not until 1904 that Bertram Boltwood demonstrated that "the percent of radium in a mineral appears to vary directly as the percent of uranium present". Boltwood fixed the ratio at one part radium per 1,350,000 parts uranium. This discovery created a new market for uranium that soon grew far beyond the earlier market, which had depended on uranium's limited use in glassmaking, ceramics, and steel.

> ***"This time it is argentiferous radium which bears the brunt of a presuming novelty. Our lively trans-Atlantic contemporary, L'Echo des Mines de la Metallurgie, notes as a brilliant Italian invention an alloy composed of copper, iron, silver, phosphorous and radium. The result of this wild alloying of old comrades is a 'metal harder than steel, as brilliant as gold, from which it cannot be distinguished, and as good a conductor as copper'. But better than this, for it bears the stamp of the best medieval alchemy, this 'argentiferous radium' weighs less than copper, and changes not its beautiful color with any physical or chemical agent. The name of the thrifty patent owner is coupled with the greatest of European bankers. It is interesting, if true. We will go further — it is interesting if only half true." (E&MJ, May 1905)***

As early as 1903, mining journals had begun to discuss radium in some detail, and the little-understood physical properties of radioactivity were subjects of much interest, as well as many misconceptions (see grey boxes).

By 1904, the "pitchblende excitement" had prompted the first public promotion of a radium mine. A company called Uranium Minerals Ltd. was formed in London with a reported capital of $300,000 to purchase and work the Thors mine in Norway. One journal correctly called this venture a "doubtful enterprise".

At the time, radium production was being carried out solely by the Société Centrale des Produits Chimiques of Paris, using pitchblende ores. However, as the Austrian government placed an embargo on the export of pitchblende from Joachimsthal, interest turned to the possible commercial-scale extraction of radium for carnotite, which was available from mines on the Colorado plateau.

Throughout the world, prospectors began actively seeking radium-bearing ores. In 1904, prospectors found a specimen containing over 70-percent uranium at Lake Pied des Monts, near Murray Bay in Quebec. The Canadian government, a few years later, paid a bounty for the discovery of uranium-bearing ore specimens.

In Cornwall, England, where pitchblende had long been found but where its mining and collection from waste dumps had but recently been largely discontinued, the excitement over radium caused a new rush to look for the ore. Within a few years, the demand for pitchblende was such that streets in several towns were dug up to recover pitchblende that had been discarded from tin mines years before. A mining journal commented in 1909 that "the richest prize in the mining world is a vein of pitchblende ore".

By 1906, carnotite ore had been reported, in addition to the now numerous claims in Colorado and Utah, from Olary in South Australia. This area, which became known as Radium Hill, subsequently went through a prolonged period in which overzealous claims about its reserves, as well as poor business practices, made it a much talked about, but only minimally-producing uranium area.

By 1909, various types of uranium minerals had been reported in several other countries as well including Sweden, Norway, and Portugal. In Sweden, a radium-producing concern was started in a suburb of Stockholm by the Kolm Company to process ores from a property at Billingen. ("Kolm" is a type of coal occuring in alum schists in Sweden, which was believed to contain about two-percent uranium). Near Tvedestrand, Norway, miners reported finding uranium ore reportedly containing over 60-percent uranium in old apatite and feldspar workings.

In Portugal, a British company took a concession to develop several uranium claims that had been discovered years earlier. In contrast to the Swedish and Norwegian sites, these properties in Portugal soon began supplying a regular stream of good-quality ore into the market, and continued to be actively mined for many years. Their ore went almost exclusively to France.

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URANIUM AS A GLASS TINT

Uranium's first known commercial application was as a coloring agent in the manufacture of glass and ceramic glazes. In 1826, Josef Riedel's glassworks in Bohemia introduced a new line of green and yellow glass made with uranium called "Annagrun" or "Annagelb" after Riedel's wife Anna. The unusual iridescent green and yellow tints produced by the recently discovered element became very popular and, by the 1830s, "Anna" glass was in commercial production. The nearby Joachimstal mines provided the uranium from pitchblende ores.

By 1843, a French glassworks at Baccarat was offering yellow and green-tinted glass made with uranium oxide which they called "cristal dichroide". Soon afterward, they introduced an opaque green glass known as Chrysoprase, again using uranium to produce the color. In England, the firm of Lloyd & Summerfield also began offering uranium-colored glassware.

In 1885, the Mt. Washington Glassworks in Boston (USA) began producing "Burmese" glass, which had characteristic salmon pink and lemon yellow tints. The uranium oxide used in this glass was worth about $1.00 per pound in 1885. The glass's formula was also used for a set of glassware presented to Queen Victoria and Princess Beatrice which became known as the "Queen's Design". Although other American glassmakers used uranium, the Burmese glass become one of the best known of such products.

By the early part of the twentieth century, uranium glass began to decline in popularity. It did, however, find a brief application in the manufacture of the bright yellow automobile headlamp lenses that were fitted to some cars between 1915 and 1930. This glass required as much as 30-percent uranium oxide to attain the desired color, and was rather expensive to produce. Even as late as the 1960s, uranium was occasionally used to make scientific glassware that required certain optical or chemical properties.

In addition to its use in glassmaking, uranium salts were used to color ceramic glazes. Uranium-based glazes also enjoyed some popularity in architectural ceramics; their mild yellow color may still be seen in Europe on facings and borders of buildings.

Although demand for uranium ores did increase with the excitement over radium, the early radium extraction processes were inefficient. From 1900 to 1910, ore prices remained relatively constant, although radium prices escalated rapidly.

Advances in Radium Production Technology

Production of commercial quantities of radium required the development of more efficient processes for refining radium from its host ore. The initial extraction processes were largely scaled-up versions of the Curies' original techniques. However, in 1909, Sir William Ramsay, a chemist associated with the British Radium Corporation, succeeded in extracting a small sample of radium using his own process, which reduced production time of the desired end product — purified radium chloride or bromide — from as much as a year to a few weeks. This advance in chemical technology made possible a rapid increase in worldwide radium production, and allowed radium to be extracted from lower-grade, previously uneconomical ores such as carnotite.

> ***"Even if a store of radium should be found the extraction of the substance will be a great difficulty, as merely to enter a room containing two pounds would probably destroy the sight, burn off all the skin on the body, and quickly kill." (Mining and Scientific Press, March 1903)***

By 1910, in addition to the French factory and the Imperial Austrian radium works at Joachimsthal, the British Radium Corporation had become an active supplier of radium, and was in turn buying Colorado carnotite ores. The value of the ore was from $100 to $300 per ton in uranium and vanadium. At the time, freight from the Paradox Valley area cost about $20 per ton to the railhead at Placerville, Colorado, and then about $13.50 to Europe.

The steadily increasing worldwide demand continued to drive up prices for the small available supply of radium, whose only use was for largely experimental medical treatments and scientific experiments. By 1911, the selling price for the pure radium equivalent (it was typically sold as radium bromide, containing 53.6 percent radium) had reached $120,000 to $160,000 per gram. Radium "banks" were established in Paris and London to loan small quantities at the rate of $200 per day. Radium was the most expensive commodity of its day, and speculators and market observers awaited even higher prices.

> ***"In a recent issue of Vanity Fair we read an announcement. . . to the effect that a golf ball with amazing proclivities is now for sale. When hit, we are told, 'the radium salts in the plastic center start a wave of momentum which gives it a great resiliancy. The ball literally is alive, and the released energy actually fights to free itself. Hard hit — it races yards farthest.' Thus we learn that the game does not necessarily go to the adept, to the strong, or to the experienced, but to the one who can afford to patronize a high-class store to buy the ball with radium salts in the center. Alas for golf as a sport." (E&MJ, December 1922)***

Radium Production in the USA

In the USA, growing radium imports were causing much concern. It was not until 1913, however, that industrial-scale radium production commenced in the USA. The first commercially-available pure radium salt was produced from Colorado carnotite ores by the Standard Chemical Co. in Pittsburgh, Pennsylvania. The firm's orders from Europe immediately greatly exceeded its initial capacity of one gram radium per month. Soon after, the Radium Company of America also began operating a production facility in Pennsylvania.

As the Pennsylvania plants had easy access to much greater quantities of ore than did European producers, the USA quickly became the leading producer of radium. In 1913, the Standard Chemical Co. reported production of between 12 and 13 grams of radium equivalent, requiring a minimum of about 3,000 tons carnotite ore. (Assuming 100-percent recovery, it takes about 215 tons of two-percent U_3O_8 ore to produce one gram of radium.)

URANIUM-STEEL ALLOYS

During the late 1800s, European steelmakers began experimenting with uranium as an alloy in steel. The first experiments appeared to offer a bright future for these alloys and, in 1900, an article published in the mining press noted that:

"the tendency of modern engineering leans toward the production of alloys of the rare metals instead of the metals themselves, a circumstance which has led to the development of a peculiar industry aiming at the manufacture of a great number of metallic alloys, among which the undetermined compounds of uranium and steel play a significant role. Especially in France, the beneficial effect produced by the addition of a small percentage of uranium carbide to steel has been realized, so that an extended manufacture of war material from that alloy has sprung up there in the last two years. It seems that a compound of this kind surpasses any other product obtained by mixing and incorporating ferro or carbon alloys with fluid steel, as it increases the tensile strength, toughness and elongation of that substance remarkably."

This early enthusiasm about uranium's properties as an alloying agent, however, soon gave way to a more realistic view. One reason that steelmakers' interest in uranium had declined was the growing success of vanadium-steel alloys, which offered much greater improvements in strength and hardness and which were vastly easier to manufacture than those of uranium.

In addition to experiments conducted by the French navy, the Krupp steelworks in Essen, Germany had by 1907 carried out trials using ferro-uranium fabricated into steel plates for ships. This material, however, offered insufficient improvement over cheaper, more easily fabricated steels, and its military use never really reached the production stage.

By 1916, metallurgists had begun to test uranium alloys in a more systematic way. A comparative test published in *Iron Age* showed uranium-steel tools outperforming regular high-speed steels by a considerable margin in controlled drilling. However, the difficulties in making ferro-uranium a commercially-viable material also were becoming obvious. One major problem was controlling the percentages of carbon and uranium in the final product. Although some further testing did follow, uranium subsequently found little application in steelmaking.

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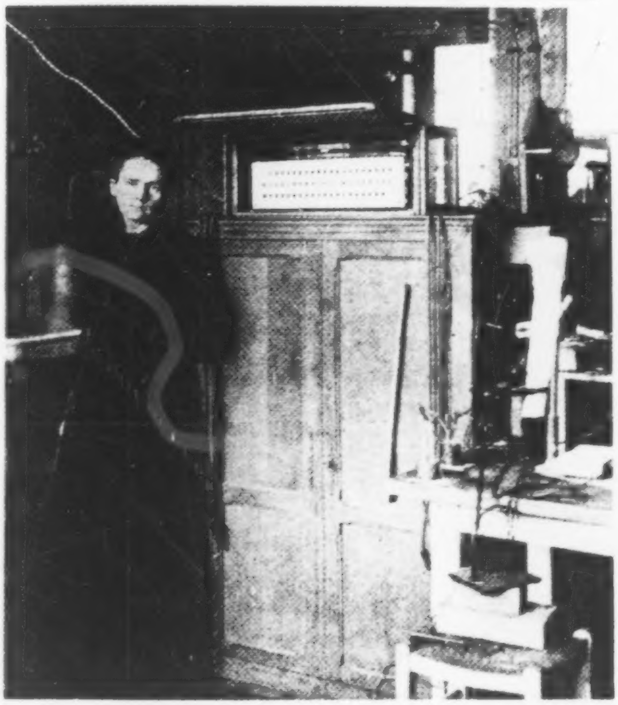
The increased demand for uranium ores was rather evenly matched by increased production, and prices for ore remained steady or increased only slightly. Between 1912 and 1914, US uranium production increased from about 58,000 pounds U_3O_8 equivalent to about 174,000 pounds. Prices for two-percent ore were around $2.00 per pound of contained U_3O_8. In England, output of pitchblende ore increased even more dramatically, even though its production had been highly erratic for some years, rising from 42 longs tons of ore (containing approximately 35,000 pound U_3O_8 equivalent) in 1912 to 344 tons (with about 300,000 pounds U_3O_8) in 1914. Nearly half of the US uranium ore production in 1913 was exported to Europe.

The Uranium and Radium Markets - 1914 to 1923

From the beginning of World War I in 1914 to 1922, US uranium and radium producers virtually controlled the world market. Large increases in production could not come from European producers, whose pitchblende deposits were already strained, and the upheaval and devastation caused by the war had disrupted much of the industrial and labor infrastructure in Europe. However, by 1923, US production of both uranium ore and radium had practically ceased. The reason was the entry into the world market of a production giant, whose large reserves, high ore grade, and low cost of production quickly made it almost the sole competitive source for uranium materials. This giant was the Union Miniere du Haut Katanga, a British-Belgian syndicate operating mines in the Belgian Congo.

At first, the outbreak of war in Europe had little effect on either worldwide radium demand or uranium production. Carnotite from Colorado and Utah had become the primary source of uranium for radium production (other uses for uranium ore were, by comparison, minimal), and US radium manufacturers were making as much as 90 percent of the world supply.

By 1915, US uranium ore production had slowed almost to a halt because of the sudden drop in European demand, but as the war dragged on, US uranium output again increased. From about 175,000 pounds U_3O_8 in 1915, output rose to about 212,000 pounds in 1918 (with a high of 268,000 pounds U_3O_8 in 1916). US radium production had, by the beginning of the war, just become fully commercialized, and rose from 2.1 grams (pure element equivalent) in 1913 to 13.6 grams in 1918. Radium prices maintained a high level, but as rising US production began to influence the market, prices began dropping somewhat and averaged around $120,000 per gram. Demand remained strong, aided by a new application for radium compounds — in "self-luminous" paints.



Madame Curie in her laboratory, 1912. (Reprinted from *Madam Curie, A Biography*, 1939, Doubleday, Doran & Company, Inc.)

Radium began to find a military use during the war, as self-luminous radium paint was used on rifle sights, inside rifle scopes, and on watch dials and other types of instruments to avoid the need to provide lighting during the night, which might betray a soldier's presence to the enemy. The demand for the luminous watch-dial alone raised one use for this material to a fair-sized industry.

The British Admiralty issued a specification for such paint that required 0.4 mg of radium bromide per gram of zinc sulfide. The radium would, however, rather quickly exhaust the zinc sulfide, and within a year would have only about half of its original luminosity. The higher the percentage of radium, the shorter the life of the sulfide.

By 1917, "radium signs" and other such articles painted with luminous paint were becoming fairly commonplace, at least in the USA. A Denver, Colorado company called the Cold Light

EARLY THOUGHTS ON NUCLEAR PHYSICS AND URANIUM

The 1890s were a time of unparalleled excitement and rapid discovery in the physical sciences, a bright new age in which scientists struggled to understand the forces and structure of the most elemental particles of matter. In November 1895, Wilhelm Röntgen discovered mysterious rays emanating from the fluorescing glass walls of a cathode ray tube — X rays. A British scientist, J.J. Thompson, at once sensed the importance of Rontgen's discovery, and began to study these unusual, highly penetrating rays; his own work with cathode rays and then X-rays culminated in his identifying, in 1897, the first sub-atomic particle — the electron.

Rontgen's X-rays also fascinated other researchers. Henri Becquerel, a leading expert in the study of phosphorescence and fluorescence in France, was especially interested in uranium. When he heard of Röntgen's work he immediately began to test a variety of fluorescing materials for X-rays. After several unsuccessful experiments, Becquerel decided to try a uranium salt — uranyl potassium sulfate.

Becquerel immediately found that the uranium compound emitted a type of radiation. When he developed a photographic plate on which he had sprinkled a layer of uranium salt, it showed a silhouette of the phosphorescent material. However, as he had exposed his sealed photographic plate to the sun for several hours, he mistakenly thought the sunlight had activated the effect, much as the cathode rays had activated Röntgen's X-rays.

When Becquerel tried to repeat his experiment, Paris was overcast, so he put the sealed photographic plate in a drawer, uranium salt still in place. When he developed the plate a few days later, instead of a nonexistent or very weak image, Becquerel was surprised to find an image of great clarity. He had discovered the phenomenon which Marie Curie in 1898 had named radioactivity.

At the time, many of the world's most eminent physicists and chemists were struggling to comprehend the inner structure of the atom. To scientists such as Ernest Rutherford, Frederick Soddy, Marie Curie, and others, the discovery of radioactivity opened the door to this world. In 1899, Rutherford published results of his experiments, revealing ". . . at least two distinct types of radiation — one that is very readily absorbed, which will be termed for convenience the a (alpha) radiation, and the other of a more penetrative character, which will be termed the b (beta) radiation."

Working with thorium, Rutherford and Soddy soon discovered that it released a radioactive gas which eventually proved to be chemically inert argon gas. This observation of the spontaneous disintegration of radioactive elements was one of the fundamental discoveries of twentieth-century physics. The two scientists later described how uranium, radium, and thorium transmuted into different elements by radiating away part of their mass as alpha and beta particles. This in turn led to the measurement of what came to be called "half-life", or the time required for an element to change half its atoms into that of another element, or a physical variant of the same element. Soddy later termed these "isotopes".

In 1898, Marie and Pierre Curie had purified from uranium ores a new element, possessing an astonishingly intense radioactivity which they named radium. In 1903, after working with radium and other radioactive materials, Soddy published a paper stating that:

". . . the total energy of radiation during the disintegration of one gram of radium cannot be less than 10/8 (i.e. 100,000,000) gram calories, and may be between 10/9 and 10/10 gram calories. . . The union of hydrogen and oxygen liberates approximately 4x10/3 (i.e. 4,000) gram-calories per gram of water produced, and this reaction sets free more energy for a given weight than any other chemical change known. The energy of radioactive change must therefore be at least twenty thousand times, and maybe a million times, as great as the energy of any molecular change."

Soddy also stated that, "The man who puts his hand on the lever by which a parsimonious nature regulates so jealously the output of this store of energy would possess a weapon by which he could destroy the earth if he so chose."

But of all the prominent scientists, it was the Curies who became best known to the public. Marie Curie was one of very few women at the front rank of international science, and her choice of research subjects — the peculiarities of this "emanation" she came to call radioactivity — propelled her, even more than her husband and partner Pierre, into the public eye. From their joint work that produced the discovery of polonium and radium, and then their receipt of the Nobel Prize for physics in 1903 (sharing with Henri Becquerel), the Curies came to represent nuclear physics among the non-scientific public.

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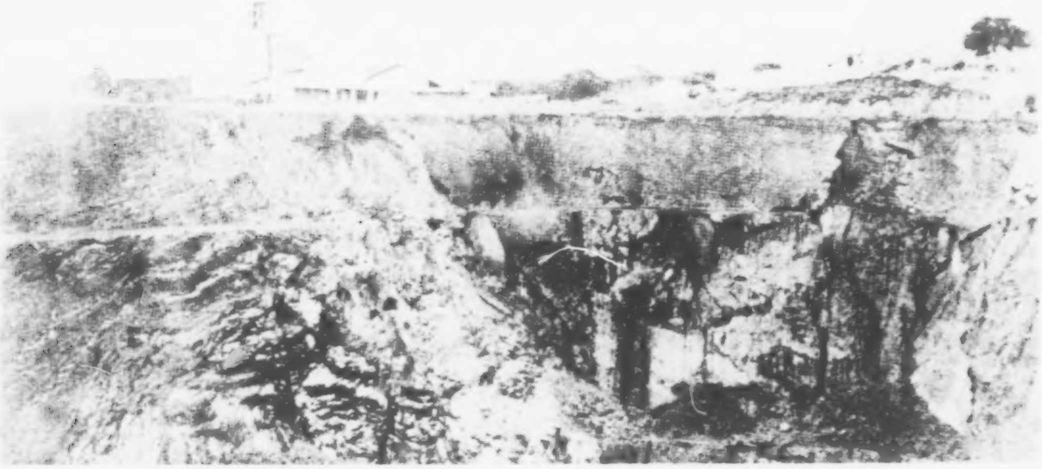

Figure 2. The Shikolobwe Mine. (Reprinted from *Union Miniere du Haut Katanga Monograph*, 1943.)

Manufacturing Co. was organized to manufacture street signs, push buttons, watch and clock dials, and other objects. By the end of the war, an estimated 95 percent of the radium produced was being used in paints, and only five percent in medicine.

The medical uses of radium had gradually become better defined since 1900 when radiation was believed to be a possible miracle cure for many diseases, including cancer. But by 1920, it had become clear that radium's therapeutic uses were limited and quite specific.

Uranium from the Congo

As early as 1913, development work done by the Union Miniere du Haut Katanga at the Luswishi copper mine in the Belgian Congo uncovered an unusual mineralization. Some small veins were found to contain a crystalline, yellow to yellowish green ore, which investigators found contained between 45- and 68-percent U_3O_8. The war in Europe interrupted further investigations at the Luswishi deposit, but in 1915 a similar discovery was made at Shikolobwe (see Figure 2), also referred to as Kasolo. Several types of uranium minerals were found at the two sites, including pitchblende (uraninite), autunite, and carnotite.

By 1921, Belgian experts had been sent to evaluate the deposits, and had immediately recommended their development. The most up-to-date and the largest radium-extraction plant was quickly erected at Oolen, Belgium to treat the ores.

Early shipments from the Luswishi deposit averaged over 60-percent U_3O_8, and the ore was available in far greater quantity than any of the pitchblende ores that had previously assayed at such high grades. Reports give the content of U_3O_8 (from the Congo) at 50 to 70 percent — a staggering figure when compared with two percent ore from Colorado and Utah. The fresh Congo supply meant that US producers were forced from the market almost overnight and, with few exceptions, the uranium mines and mills on the Colorado plateau closed down by the end of 1922.

For the first time since radium's discovery, prices began to drop substantially. Not long after production began in Belgium, radium prices dropped from \$120,000 per gram to \$70,000 per gram, and by 1923, excess supplies in the hands of US radium producers were being sold as low as \$50,000 per gram.

From the first production of radium in 1904 to the middle of 1923 — about 20 years — total worldwide radium production

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was estimated at about 216 grams, with a value of approximately $23 million. The Belgian plant was capable of producing about a third of annual world demand for radium.

The Industry from 1923 to 1942

The Belgian Congo mines continued to control the uranium industry for more than a decade and were only seriously challenged in the mid-1930's when Eldorado Gold Mines began producing uranium as a co-product at its mines in Canada's Northwest Territories. Throughout the 1920s and 1930s, however, new uranium discoveries and claims continued to be announced in many countries.

Uranium-bearing ore was, however, mined on the Colorado Plateau after about 1930, but for vanadium rather than uranium. By 1935, many of the carnotite properties that had been inactive since the early 1920s reopened. Demand for vanadium continued to increase, and the entry of the USA into World War II further stimulated mining of these and many newly-discovered deposits. In 1943, the Union Mines Development Corporation, created by the US government in conjunction with the Union Carbide and Carbon Corporation, began operating mills in Colorado to process uranium ores for use in the government's Manhattan Project, which culminated in the creation of the atomic bomb. From that point on, uranium production in the USA and around the world took on a new charcter, and radium faded from view.

Summary

Two distinct cycles are apparent in the uranium industry's early history. The first cycle ran from the discovery of the element uranium in 1789 to roughly the discovery, then the isolation of radium in 1904. During this period, ore production was small and demand focused on the use of uranium in ceramics and glassmaking, with some late experimentation into using uranium in steel.

The second cycle of uranium production began in 1904 and included the discovery and development of extensive carnotite deposits on the Colorado Plateau, with radium as the desired end product. Uranium compounds *per se* had little use other than the small amounts used in glassmaking and ceramics. By 1923, the Union Miniere du Haut Katanga, had taken over almost the entire world uranium and radium markets, through its control of the lowest-cost and highest-grade deposits in the Belgain Congo. For the next decade and beyond, uranium mining elsewhere in the world was largely nonexistent, and only in the mid-1930s did other producers manage to break the virtual monopoly of the Belgian syndicate.

> ***"Though, at the present time, the whole matter [of radium] is of no immediate practical importance, the material interests of the race are involved in no remote degree. Our present civilization is based on the possession of coal, and the output of mechanical power is increasing rapidly from year to year. In the not very distant future the supply of this indispensable commodity will be exhausted, and unless the human race can find some other source of energy, a relapse into barbarism seems inevitable. Recent experiments at Cambridge go to show that it may not prove wholly impossible to unlock the enormous reserves of internal energy, which, on the hypothesis now under debate, are assumed to be locked up in the atom."***
> ***(M&SP, reprinted from Engineering, October 1906)***
>
> ***"Uranium has the heaviest atom known, excepting radium, which appears to be a little heavier."***
> ***(E&MJ, May 1905)***
>
> ***"Radium emanations. . .are classified as follows: (1) The alpha-rays, which are comparatively coarse particles of matter, being about the size of two atoms of hydrogen, carrying a charge of electricity, and traveling at a 20,000 mile rate per second; they have slight penetrating power. (2) The beta-rays are much finer, being only one-thousandth the size of a hydrogen atom; they are identical with the "radiant matter' of Crookes — or the "cathode rays'; they carry negative electricity, and travel at a rate of 160,000 miles per second. (3) The gamma-rays, which are not matter, but only pulses in the ether."***
> ***(E&MJ, January 1905)***

The third cycle in the history of uranium began with the atomic bomb in 1943, yet continues today as uranium finds it primary application in fuel for nuclear-powered electricity. ■

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THE RHODE RANCH PROJECT

Introduction

During the late 1970s and early 1980s, the opening of a new uranium mine in the USA was a common occurrence as high uranium prices provided the incentive for new development. Falling market prices quickly curtailed those openings and only exceptional circumstances have allowed the development of new uranium mines in today's economic environment. Chevron Resources Company and Total Minerals Corporation have combined efforts to develop the first new US open pit uranium mine in almost a decade — the Rhode Ranch project. The components of this project include the acquisition of a top-quality orebody in a district characterized by low-grade deposits; the conversion of a distant mill (84 miles from the deposit) to treat high-alkaline ore; utilization of inexpensive, spent acid from a Chevron refinery; the availability of a well-trained, experienced work force; and limited capital expenditure requirements. Chevron and Total have forged these diverse elements into one of the lowest-cost conventional uranium projects in the USA.

Reasonably-assured reserves at the deposit are estimated at almost seven million pounds U_3O_8. Mining commenced in January 1988 at a nominal rate of one million pounds U_3O_8 per year, and is expected to continue at that rate through 1995. The two companies each plan to market their own shares of production to US and foreign consumers.

Corporate Background

Chevron Corporation is an integrated petroleum company with operations in the USA and more than 95 other countries. At the end of 1987, the company had total assets of $34.5 billion and approximately 51,700 employees worldwide. Based on revenues, Chevron ranks as the fourth largest US petroleum company and one of the ten largest US industrial companies.

Chevron Resources Company, a corporate unit of Chevron Corporation, explores for and develops minerals and non-petroleum energy sources throughout the world. Headquartered in San Ramon, California, Chevron Resources Company operates the following projects:

- Mt. Taylor uranium mine in New Mexico
- Rhode Ranch uranium mine and Panna Maria uranium mill in Texas
- Vernal phosphate mine in Utah
- American Gilsonite Company gilsonite mine in Utah
- Mt. Wilkinson gold mine in western Australia
- Herber geothermal reservoir in California's Imperial Valley, which provides geothermal heat for operating a geothermal power plant
- Roosevelt Hot Springs geothermal reservoir in Utah serving a geothermal power plant
- Geothermal resource fields in Nevada supporting power plants at Beowawe and Desert Peak
- Stillwater Mining Company platinum and palladium mine and mill in Montana

Active mine exploration and/or evaluation programs are underway in the USA, Chile, Ireland, Canada, Australia, and the Dominican Republic. Chevron Resources has more than 1,100 employees worldwide.

Total American Mining, Inc., headquartered in Houston, Texas, is a wholly-owned subsidiary of Total Energy Resources, Inc., which in turn acts as the holding company for Total Compagnie Française des Pétroles (TOTAL), the international energy and mining concern. The parent TOTAL has been involved in uranium exploration and mining since 1970, and operates two mines in France (Mailhac-sur-Benaize and Saint Pierre du Cantal) that together produce approximately 1.4 million pounds U_3O_8 per year. In addition, TOTAL participates in or maintains ownership interests in other uranium projects worldwide.

During 1987, Total American Mining acquired interests in two uranium mining operations in the South Texas district of the USA. In early 1987, Total American Mining purchased the West Cole in-situ leach mine from Tenneco, who had operated it from 1981 to 1984. The project was restarted in mid-1988, and current production capacity is in excess of 200,000 pounds U_3O_8 per year. NUEXCO expects it to continue at that rate at least through the mid-1990s. Total American Mining also acquired a 45-percent interest in the Rhode Ranch conventional mine, which began production in 1988. A wholly-owned subsidiary, Total Minerals Corporation (Total), formerly known as Minatome, manages the company's interests in both projects, and handles the marketing efforts. Total is the project operator at West Cole, while Chevron is the operator at Rhode Ranch.

On August 9, 1988, Total announced that it had acquired the Alta Mesa in-situ property in Brooks County, South Texas, roughly 90 miles from West Cole. The company estimates recoverable reserves at five to twenty million pounds U_3O_8. Previously, some 400 test holes had been

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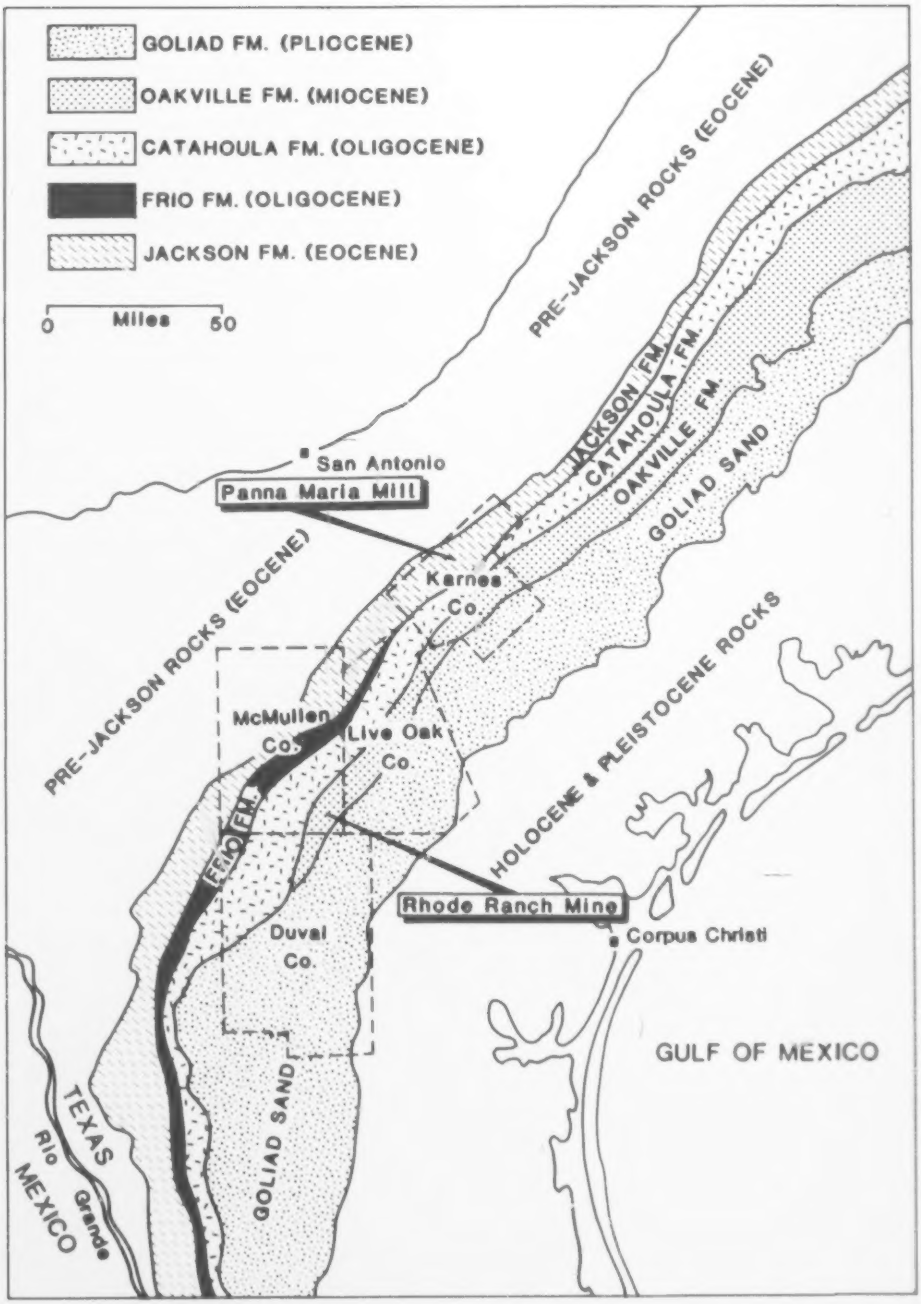
GOLIAD FM. (PLIOCENE)
OAKVILLE FM. (MIOCENE)
CATAHOULA FM. (OLIGOCENE)
FRIO FM. (OLIGOCENE)
JACKSON FM. (EOCENE)
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PRE-JACKSON ROCKS (EOCENE)
JACKSON FM.
CATAHOULA FM.
OAKVILLE FM.
GOLIAD SAND
San Antonio
Panna Maria Mill
Karnes Co.
PRE-JACKSON ROCKS (EOCENE)
HOLOCENE & PLEISTOCENE ROCKS
McMullen Co.
Live Oak Co.
FRIO FM.
Rhode Ranch Mine
Corpus Christi
Duval Co.
GULF OF MEXICO
GOLIAD SAND
TEXAS
Rio Grande
MEXICO

Figure 1. Geologic map of the South Texas Uranium District.

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RAW MATERIALS

drilled on the property, and Total will be studying that data and developing a production plan over the next six months. Initial production is scheduled for 1992.

Regional Geology

Uranium deposits of the South Texas district occur in Tertiary sediments which outcrop in a trend closely paralleling the shoreline of the Gulf of Mexico. The trend of mineralization extends to the southwest about 400 miles from Fayette County to Starr County on the USA/Mexico border. (The mineral trend is known to continue another 100 miles into Mexico). Figure 1 shows the outcrop pattern of the Tertiary formations throughout the mineral trend. The principal areas of interest are within McMullen, Karnes, Live Oak, and Duval counties. Important uranium mineralization has been found in eight stratigraphic units of late Eocene to Pliocene age.

Evidence of structural activity throughout the district is limited to a one-degree dip of the beds toward the Gulf Coast and to minor faulting which tends to parallel the strike of the Tertiary formations.

The Tertiary formations of South Texas were deposited in a coastal marine and continental environment. The uranium-bearing formations consist of thick tuffaceous and clay units (the Fant Tuff and Frio Clay); sandstone units (Oakville, Tordilla, Deweeville and Dillworth); and fine to coarse-grained sandstone and conglomeratic units (Goliad and Soledad). The entire sequence is characterized by oscillating depositional patterns marked by facies changes which commonly include any combination of formational deposit. Carbonaceous material and lignite may occur in light to heavy concentrations throughout the more sandy units. The predominant depositional patterns of the Eocene formations are related to beach and barrier-bar structures; the younger formations are associated with continental deposition consisting of fine to coarse sand and conglomeratic units. The source of the fine to coarse sand and conglomeratic material may have been in West Texas and northern Mexico; the tuffs were deposited during regional volcanic activity.

Uranium mineralization is commonly found in sand and sand/clay facies filling erosional channels, and in well-defined beach and barrier structures. The most important ore deposits are associated with depositional changes in fluvial channel environments. A greater concentration of uranium often occurs where lignite and carbonaceous material are abundantly dispersed throughout sand units, especially where permeability is relatively high. There is also an apparent relationship between the concentrations of uranium and clay minerals present in certain sand/clay host units. The clay particles acted to restrict the normal flow of mineral-bearing solutions and, consequently, afforded the rapid precipitation of uranium, enriching the clay-bearing unit. The uranium deposits of the district are believed to have been formed by epigenetic process-placement of the uranium which occurred after and totally independent of the deposition of the host formation.

The principal source of uranium mineralization is considered to be the thick volcanic ash (tuff) sequence of Miocene Age that covered the entire region. As the tuff formation eroded, primarily toward the gulf, the contained uranium was leached from the tuff to be absorbed and transported downdip by oxygenated ground water. Precipitation of the uranium in a favorable host rock occurred in a reducing environment. This environment was probably created by the upward migration of hydrogen sulfide and/or methane gas associated with deeper deposits of oil and gas. Formation permeability and faulting are the main factors controlling the migration of the reductants to the surface.

Site Geology

Uranium mineralization at Rhode Ranch occurs within fluvial sediments of the Oakville Formation at depths of 75 to 180 feet. In the mine area, the Oakville has been subdivided into three members, each of which has two zones. These members are from upper to lower, the Magnolia, the Manuel, and the Rincon.

Uranium occurs primarily in the Manuel and Rincon. The Magnolia member is approximately 100 feet in thickness and is composed of an upper clay zone and a lower sandy zone. The upper zone has been partially eroded over much of the mine area. The Manuel member includes a silty and sandy clay zone (10-35 feet in thickness) and a lower sandy zone (10-25 feet in thickness) capped by calcite cementation. An upper clay and a lower sand comprise the Rincon which has a total thickness of about 30 feet, but which pinches out in the western portion of the mine area.

Mineralization at Rhode Ranch occurs in roll fronts primarily as coffinite and is often encapsulated in pyrite and/or marcasite. A northeast-trending fault about one-half mile to the southeast of the deposit is thought to be the source of sulfur (from hydrogen sulfide) for these minerals.

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Several stages of sulfidization and reduction are in evidence in the roll fronts. It is postulated that re-reduction may be responsible for the higher-than-average (for the South Texas district) ore grades encountered at Rhode Ranch.

Reserves

Current reserves at Rhode Ranch have been estimated by Chevron and Total to include almost 7 million pounds of mill-recoverable U_3O_8. This estimate was compiled from a detailed analysis of some 1,400 drillholes in the immediate mine area utilizing the polygonal method of reserve estimation, and with full consideration of the economic character of each drillhole. Cutoff criteria included a minimum thickness of 2.0 feet at a grade of 0.0S percent U_3O_8. Dilution in the amount of 35 percent has been added to arrive at an estimated mill head grade of 0.26 percent U_3O_8.

Chevron and Total are currently converting the reserve analysis to a PC-based Kriging system which will allow additional flexibility and speed. In addition to the 1,400 drillholes in the immediate mine area, another 5,000 holes were drilled on other areas of the property. All of the drillholes were logged for gamma radiation, self potential, and resistivity. Interpretation of the gamma activity provides definition of the ore grade and thickness of mineralization, while the self potential and resistivity assist in analysis of the lithology. Neutron density logs were included on many drillholes and have proved valuable in defining the thickness, hardness, and extent of the caprock.

Licensing and Environment

In Texas, uranium mills are regulated by the Texas Department of Health (TDH), and uranium mines by the Railroad Commission of Texas (RRC). Both agencies have responsibilities for regulating tailings ponds and other waste water ponds associated with milling.

Chevron obtained the initial radioactive materials license for the Panna Maria mill on September 23, 1977. An application to renew that license was submitted in 1980 and Chevron was authorized to continue operating under the terms of the original license pending processing of the renewal application. Following the elimination of a substantial backlog of permitting activities, the TDH published an environmental assessment of the mill license renewal in September 1987. The public hearing process required for renewal was recently initiated, but may extend for some time since local opposition to the nuclear fuel cycle has been voiced only recently for the first time. This opposition, however, is not expected to be substantive.

The primary concern addressed by the mill licensing permit is the release of radioactive material into the atmosphere and/or groundwater. The Panna Maria mill incorporates extensive controls on each potential release and operates as a no-discharge facility. Drainage controls and impoundments for the confinement of liquid waste include the following: Three drainage-collection ponds on the periphery of the tailings area, three mine and mill drainage ponds, an industrial waste pond, a molybdenum sludge waste pond, the main tailings disposal area, and an emergency tailings pond.

Potential atmospheric releases are subject to an aggressive dust control program at the ore stockpile as well as separate high-efficiency dust collection/scrubbing systems on the yellowcake dryer and the lump breaking/packing unit. Leach tank fumes are collected and scrubbed before discharge and the ammonia precipitation circuit is covered and provided with a vapor collection, scrubbing, and venting system.

The operating permit for the Rhode Ranch mine was issued on June 8, 1987 by RRC as a transfer of the original permit obtained by Anaconda. The transfer process included a commission review and a public notice/public comment period, but was nevertheless completed in less than twelve months. A reclamation bond of $3.3 million was set for the total permit area of 8,900 acres.

Mining

Ultimately, the Rhode Ranch orebody will be mined over a distance of almost two miles (see Figure 2). The pit will be narrow, about 200 feet in width on average — a condition which requires the utmost in planning and coordination in order to ensure a continuous cycle of stripping and mining.

The mining sequence includes topsoil removal, overburden stripping, waste mining, ore mining, backfilling, and reclamation.

Topsoil is removed sequentially by scrapers from all areas to be disturbed during the mining process and is either stockpiled for use in reclamation or used to construct a continuous drainage berm around the periphery of the pit. It is notable that all areas subject to disturbance during the mine life (except for the shop/office area) are

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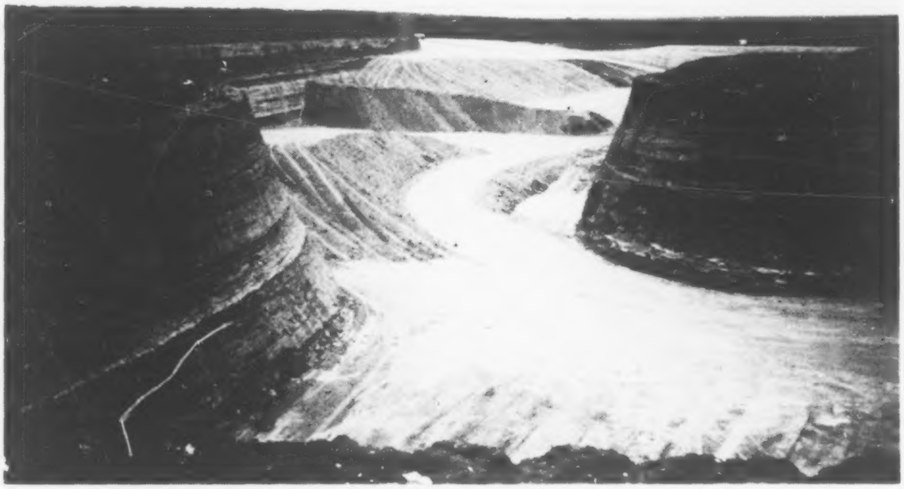

Figure 2. The Rhode Ranch Mine.

located within the ultimate pit boundaries in order to minimize reclamation requirements.

The overburden removal fleet includes 44-cubic yard scrapers and tracked dozers. Most of the overburden can be ripped with the tracked dozers to facilitate loading, but some 5 to 10 percent requires blasting. Blast holes are drilled on a 7 foot x 7 foot pattern and are 3-1/2 inches in diameter. The explosive is ANFO and detonation is by primacord. The total quantity of overburden to be removed during the life of the mine is approximately 21-million bank cubic yards, or 15-bank cubic yards of overburden per ton of ore.

The mine plan incorporates a continuous mining/backfilling system which minimizes the stockpiling of overburden. Even though mining commenced only a few months ago in the early spring, the initial mined out area has been completely backfilled and is now ready for topsoiling and seeding. The maximum overburden stockpile will be about 3.7 million BCY.

Hydraulic backhoes with a bucket capacity of about 2.5 cubic yards are used to selectively mine the ore in thin layers to prevent dilution. Waste and low-grade mineralization occurs in association with the ore at a ratio of about 4.5:1. The total quantity of this waste will amount to 6.3 million tons over the life of the mine. Ore is loaded into 30-ton, off-highway end-dump trucks which haul to the ore stockpile. At the ore stockpile, a front end loader loads 25-ton contract haul trucks for the trip to the Panna Maria mill some 85 miles distant. These trucks complete two round trips per shift and operate two shifts per day.

Work schedules at the mine are designed to provide a blend of high equipment utilization with maximum control of the ore mining process. The stripping operation works two 10-hour shifts per day, four days per week. Mining, however, occurs during daylight shifts only, seven days per week, with two crews working alternate weeks of 80 hours per seven-day period.

One of the key factors in the decision to proceed with the Rhode Ranch project in spite of low uranium prices was the availability of almost all the mining fleet from the Panna Maria mine which ceased operation in 1985. The availability of this equipment, along with that of the Panna Maria mill, minimized the capital investment required to initiate the project.

Grade Control

As in most roll-front uranium deposits, mineralization at Rhode Ranch can exhibit both gradational and sharp

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boundaries which must be carefully defined during the mining process in order to limit dilution to acceptable levels. The grade control process begins with the compilation of "slice" maps at one-foot intervals for the entire orebody. These maps are issued to grade control technicians, as required, for each specific area of the mine as it is developed. The maps provide an estimated outline of the ore derived from drillhole data. As each two-foot mine bench is exposed, the technicians adjust this estimated outline to actual by probing the surface of the bench with T-probe scintillometers. Additional definition is obtained by drilling small diameter holes to a depth of two feet with hand-held augers at intervals of 10 to 20 feet. The cuttings from these drillholes are assayed by the beta/gamma method at a laboratory trailer located in the pit. Strict adherence to grade control guidelines has limited dilution to approximately 20 percent. The original mine plan had made allowance for dilution of 35 percent.

Personnel

With a work force of 125 employees, the Rhode Ranch/Panna Maria project's productivity is 8,000 pounds U_3O_8 per man year, one of the highest levels in the US uranium industry. These employees are distributed as follows:

Mine	60
Mill	49
General & Administrative	16

Certainly, a major portion of the project's high productivity can be directly related to the high level of experience within the work force. Most of the mine and mill employees have been at Panna Maria since startup in 1979, and had worked in the industry for other producers prior to that time. The work force is non-union and turnover is negligible.

Milling

Flexibility has been the watchword at Panna Maria, as the mill has now performed five entirely different uranium recovery operations.

The Panna Maria uranium mill commenced operations on February 23, 1979 as an integral part of Chevron's first mining project. That project was based on the exploitation of three low-grade (0.05% U_3O_8) orebodies adjacent to the mill. A $50 million investment was required to develop the project which produced a total of 5.2 million pounds U_3O_8 from 5.2 million tons of ore. This production was obtained from the East, West, and Swientek open pits at an average rate of 2,500 tons per day. Mining at the final West pit was completed in May 1985, and all three pits have been fully reclaimed (see Figure 3). Overall uranium recovery for the project was 93.5 percent.

During the period July-November 1985, following the completion of mining, much of the acid within the tailings pond was neutralized with caliche obtained from nearby sources. The treated water was used for dust suppression during reclamation, and uranium present in the fluids was recovered at a rate of about 225 pounds per day.

Tailings neutralization was suspended in November 1985 in order to prepare the mill for the processing of high-grade (0.50% U_3O_8) ore from Chevron's Mt. Taylor underground mine in New Mexico. These preparations, including the construction of a rail siding to receive the ore, were completed in early 1986. As an interim activity prior to startup on Mt. Taylor ore, the Panna Maria mill processed some 4,000 tons of by-product calcium flouride from a conversion plant. This material contained in excess of two percent U_3O_8. The Panna Maria mill was also used previously to dry uranium-bearing slurry produced at Chevron's Palangana Dome in-situ leaching

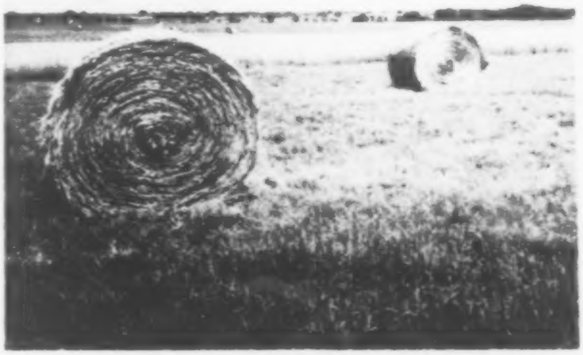

Figure 3. Reclaimed area of the Panna Maria Mine.

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project. Ore from Mt. Taylor was milled at Panna Maria during the period April 1986 to Febrruary 1988, with total uranium recovery exceeding three million pounds during this period.

The recovery process at Panna Maria includes the following basic steps: ore receiving, grinding, leaching, solid-liquid separation, clarification, solvent extraction and product precipitation, dewatering, and drying.

Ore Receiving

Ore from the Rhode Ranch mine is hauled by truck to Chevron's Panna Maria mill at Panna Maria, Texas for processing. The haulage route covers 84 miles of rolling ranch and farmland, through which the subcontractor's 25-ton, over-the-road, covered trucks make two round trips per shift.

The ore is dumped on a prepared stockpile pad in a series of windrows and separated, as required by grade, carbonate content, or other factors which might influence the recovery process. Notably, dust on the stockpile pad is controlled by spraying water over the entire area with irrigation-type nozzles located around the perimeter of the pad. The paid itself is sloped to direct all drainage toward a central storage pond.

A front-end loader retrieves ore from the windrows and dumps it onto a 24-inch grizzly covering the coarse ore bin. Oversize pieces are reduced with a tractor-mounted pneumatic pick. Coarse ore is reclaimed with an apron feeder and travels by belt conveyor to the semi-autogenous grinding (SAG) mill.

Grinding and Leaching

The SAG mill is 16.5 feet in diameter. It utilizes a 5- to 6-percent ball load and is powered by a 500 HP motor. The ore is wet ground with hot (160 degrees F) water from a geothermal well tapping the Carrizo aquifer. This heat accelerates the subsequent chemical reactions at considerable savings in fuel cost. Finely-ground ore is pumped from the SAG mill to a series of wooden leaching tanks 24 feet in diameter and 24 feet high. It is in this leaching process that the flexibility of the Panna Maria mill has been further tested (see Figure 4).

Ore from Rhode Ranch has an average equivalent carbonate content of fifteen percent, whereas ore from the original Panna Maria deposits contained only about five percent carbonate. The increase in carbonate content potentially could result in high acid consumption as well as foaming problems. Both of these concerns were solved by changing from a single-stage leach to a two-stage leach which utilizes a "spent" acid from Chevron's El Paso refinery. The first stage leach performs as an "acid kill" circuit, neutralizing excess acid from the second-stage leach. In the first-stage leach, virgin sulphuric acid and high-acid recycled solution from the second-stage leach are contacted with freshly ground ore. The second-stage leach utilizes the "spent" (approximately 90 percent

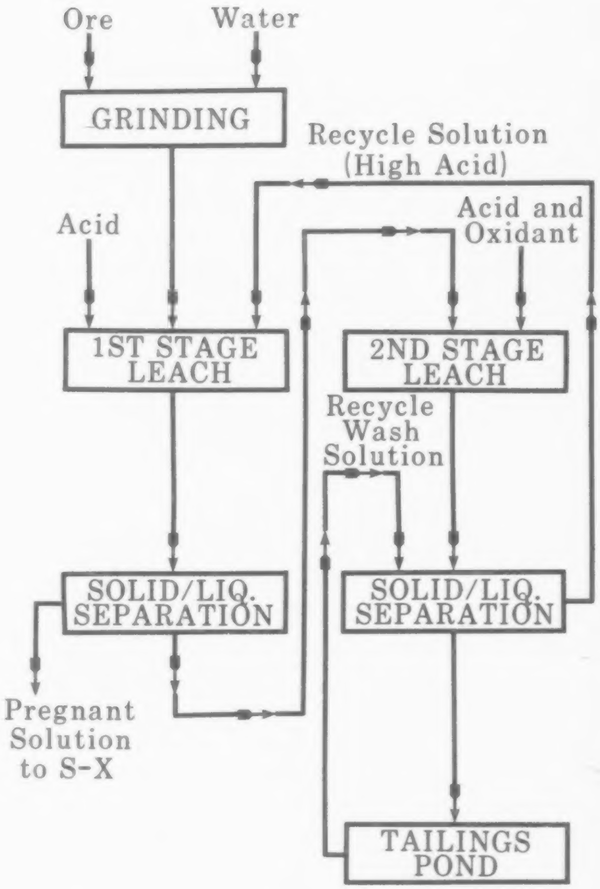

Figure 4. Leaching circuit flowsheet.

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strength) refinery acid. Concentration of acid is maintained at a high level to maximize uranium recovery. Both stages act to bring the uranium into solution after oxidation with sodium chlorate. Acid consumption in the two-stage process is still relatively high at about 300 pounds per ton of ore, but is some 25 percent less than in a single-stage leach. Panna Maria ore required 100 pounds of acid per ton of ore. Total leaching time currently is 16 hours — 0.5 hours in the first stage and 15.5 hours in the second stage.

Separation and Clarification

Uranium-carrying (pregnant) solution is separated from the barren, residual rock particles (tailings) in a five-stage series of counter-current decantation steps. Each step utilizes a large thickener tank 110 feet in diameter and 15 feet in height. In these tanks, solution flows in one direction and progressively is enriched, while the tailings flow in the other direction and are progressively depleted. A flocculent is added to aid particle settling. Tailings are discharged to a confinement area (tailings pond).

Pregnant solution is passed through a series of anthracite sand filters to remove undissolved solids.

Solvent Extraction

Following clarification, the pregnant solution is pumped to the solvent extraction circuit where the dissolved uranium in acid/aqueous solution is transferred to an organic solvent containing 90 percent kerosene, 4.0 percent isodecanol, and 6.0 percent amine. Amine is the active ingredient in the process. Uranium in the pregnant organic solution is then stripped into a solution of ammonium chloride for final recovery.

The barren organic solution tends to accumulate impurities such as molybdenum which must be scrubbed continuously by a basic solution.

Product Finishing

Uranium exists within the pregnant strip solution as either a chloride or sulphate, both of which are amenable to precipitation as "yellowcake" through the addition of anhydrous ammonia. The ammonia is added to agitated precipitation tanks (Figure 5). Following precipitation, the slurry is dewatered and washed to remove soluble impurities and to reduce the water content. After dewatering in a continuous centrifuge, the uranium precipitate is fed to a four-stage hearth dryer where it is heated to 1,400 degrees C in order to decompose and expel ammonia, sulfates, and chlorides. The resulting U_3O_8 product is passed through a lump breaker to yield a powdered product within a suitable size range. It is then packaged in 55-gallon drums for shipment.

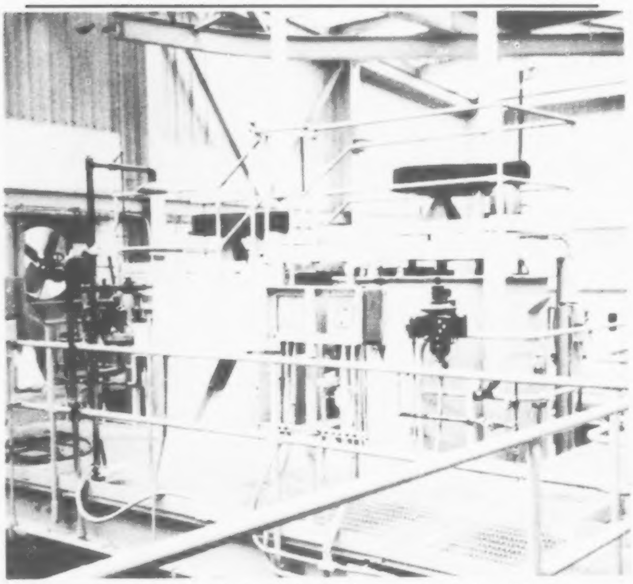

Figure 5. Yellowcake precipitation units at the Panna Maria Mill.

Operating Parameters

The Panna Maria mill was designed and constructed by Kaiser Engineers to process 3,000 tons per day of uranium-bearing sandstone ore. Installed horsepower totals 3,000, but the average operating load is about 2,500. Typical reagent consumption rates for Rhode Ranch ore are as follows:

Ammonia	6 lbs/ton of ore
Kerosene	0.25 gal/ton of ore
Sodium chlorate	6 lbs/ton of ore
Sulphuric acid	300 lbs/ton of ore
Hydrochloric acid	5 lb/ton of ore

Uranium recovery on Rhode Ranch ore is currently averaging 97 percent. The operating schedule is based on two twelve-hour shifts per day, approximately seven days on and seven days off. ■

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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	**14.15**				

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	**0.60**				

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	**15.00**				

HISTORICAL MARKET DATA

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.80	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	**1.95**				

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	**41.00**				

HISTORICAL US UF_6 PREMIUM (Relative to the UF_6 Value)

Determined as of the last day of the month indicated ($US/kg U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	**0.00**				

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay)

Determined as of the last day of the month indicated ($US per SWU)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	**65**				

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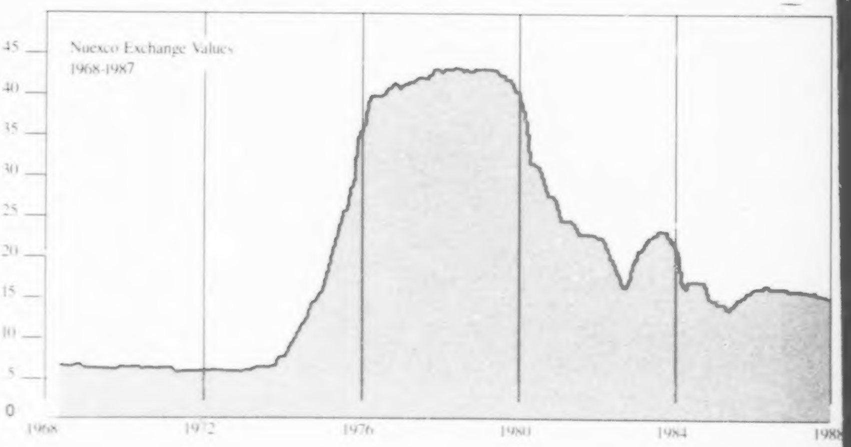
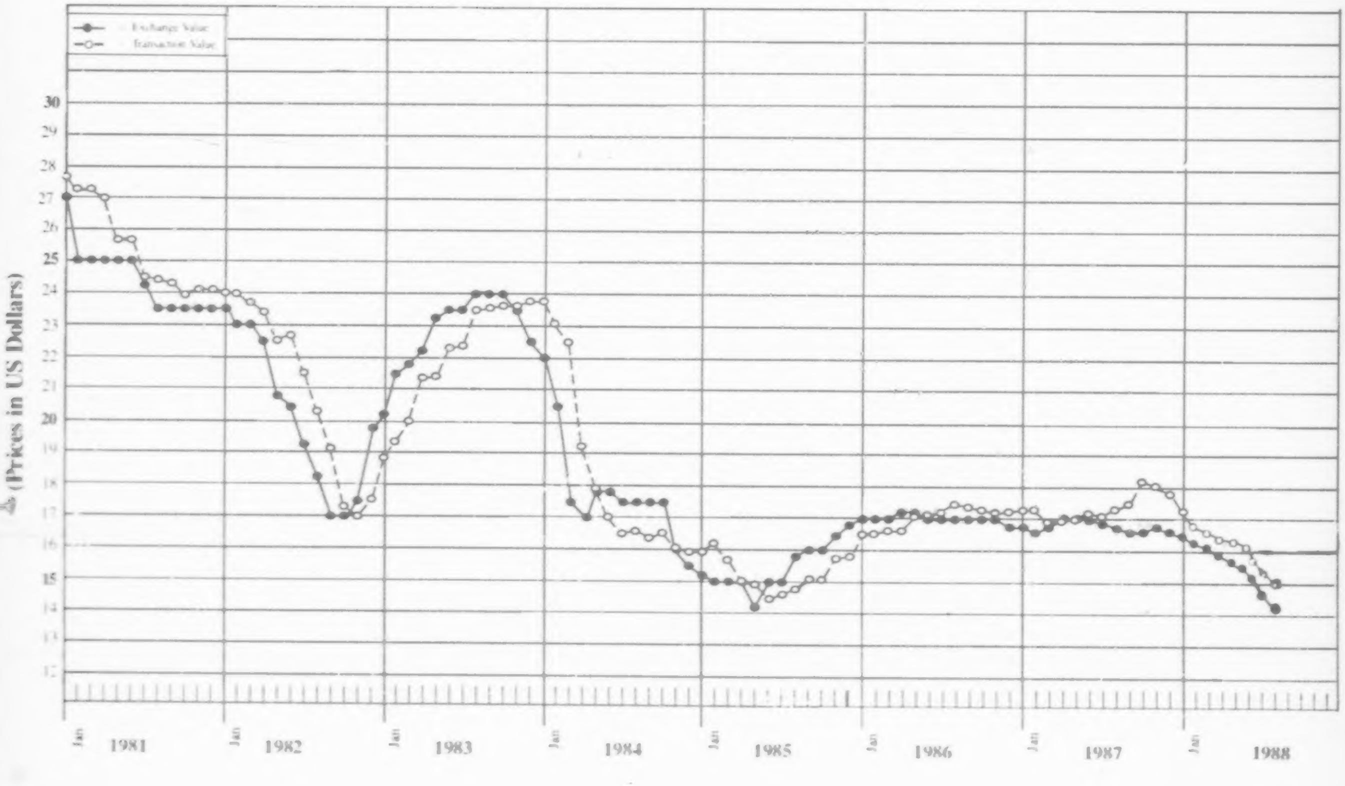
HISTORICAL MARKET DATA





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US URANIUM MARKETING ACTIVITIES STATISTICS[1]
(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium ($/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	$28.15[5]	3.6	$43.10	5.8
1981	38.5	32.6[5]	$34.65[5]	6.6	$32.90	4.4
1982	26.9	27.1	$38.37	17.1	$27.23[6]	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6
1987	13.1P		$27.45P	14.0P	$19.31P	

P = Preliminary

[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Resources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, Assistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985). 1986: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1986). 1987: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey"(1987).

[2] Sources: 1976-1982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]

(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4] Average Price in ECU per pound U_3O_8	Medium or Long-Term Contracts[3,4] Average Price in US Dollars per pound U_3O_8	Spot Contracts[3,4] Average Price in ECU per pound U_3O_8	Spot Contracts[3,4] Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75
1987	14,000	17.0	ECU 28.25	$32.50	ECU 15.00	$17.25

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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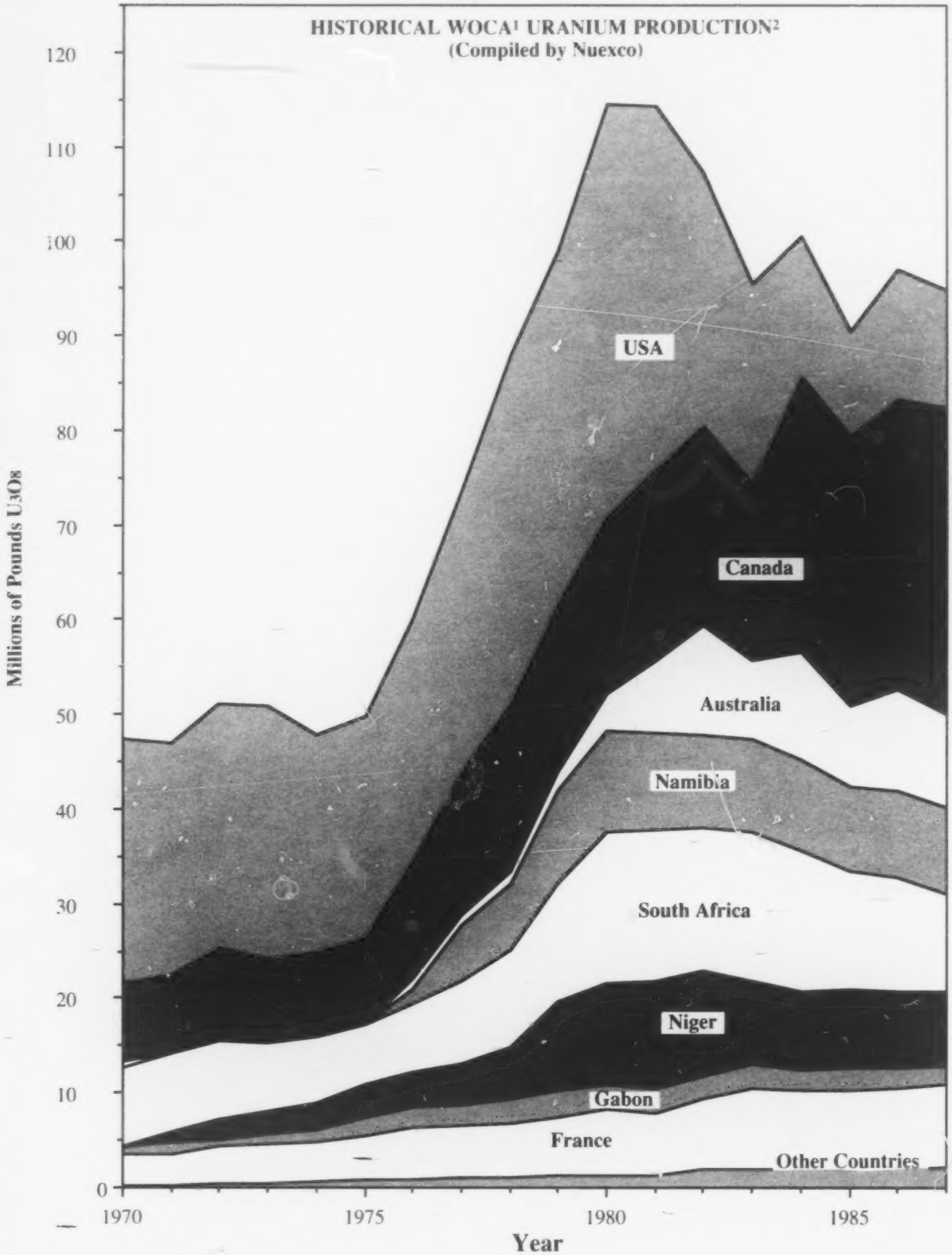

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[1] WOCA = World Outside of Centrally-Planned Economic Areas.

[2] 1987 production data are preliminary.

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GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	198.7 (Jan - May) 101.1 (Jun - Dec)[5]
1986	Avg.	155.5	101.5	104.9
1987	Avg.	168.7	108.9	—
Jan	1987	—	106.2	108.8
Feb	1987	—	108.9	108.8
Mar	1987	164.7	108.4	111.7
Apr	1987	—	108.3	111.7
May	1987	—	108.1	111.7
June	1987	167.2	108.1	111.8
July	1987	—	108.7	111.9
Aug	1987	—	110.5	111.9
Sep	1987	170.0	109.3	112.1
Oct	1987	—	108.6	112.2
Nov	1987	—	110.0	112.2
Dec	1987	172.9	111.9	112.3
Jan	1988	—	112.4	—
Feb	1988	—	112.3	—
Mar	1988	176.0	112.3	—
Apr	1988	—	112.4	—
May	1988	—	114.1	—

P = Preliminary **R** = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

[5] Base: June 1985 = 100 and includes salary earners as well as wage earners.

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CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]				
				Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.1	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.5	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1	140.4	20.47	17.50	16.50	12.63	13.53
Dec	1987	125.5	140.5	20.62	17.31	16.37	12.54	13.75
Jan	1988	126.4	140.8	20.70	17.54	16.65	12.82	13.73
Feb	1988	125.9	141.3	20.94	17.97	17.07	13.01	13.69
Mar	1988	126.2	142.0	20.55	17.88	16.78	13.10	13.62
Apr	1988	126.8	142.5	20.03	18.50	15.92	13.32	13.66
May	1988	127.2	143.4	20.92R	17.69R	17.03R	13.02R	13.58
Jun	1988	127.1	143.6	21.04P	17.69P	16.85P	13.02P	13.72P
Jul	1988	—	144.5	—	—	—	—	—

P = Preliminary **R** = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975	Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976	Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977	Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978	Avg	27.14	—	40.3	74.3	658,261	1,502,975
1979	Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	—	—	137.7	246.8	750,256	—
Jan	1987	—	—	128.9	233.9	750,496	529,682
Feb	1987	—	—	130.3	237.0	758,230	600,258
Mar	1987	88.17	197.1	132.4	239.6	763,003	536,033
Apr	1987	—	—	134.1	242.5	765,309	535,876
May	1987	—	—	135.6	243.6	761,026	531,732
Jun	1987	90.74	203.5	136.6	244.9	763,319	571,407
July	1987	—	—	138.2	246.8	764,810	624,954
Aug	1987	—	—	140.2	249.9	761,338	564,387
Sep	1987	100.79	224.7	142.0	252.4	742,417	587,707
Oct	1987	—	—	143.6	255.5	725,599	599,116
Nov	1987	—	—	144.8	256.3	734,630	616,725
Dec	1987	100.34	267.0	145.9	258.3	712,896	613,262
Jan	1988	—	—	147.2	261.5	711,983	615,889
Feb	1988	—	—	148.2	265.7	730,313	621,757R
Mar	1988	102.90R	234.0	150.2	268.4	—	619,117
Apr	1988	—	—	151.9	272.7	—	621,757
May	1988	—	—	153.1	276.1	—	—
Jun	1988	103.59	234.0	153.6	278.2	—	—
Jul	1988	—	—	155.3	—	—	—

P = Preliminary **R** = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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GOVERNMENT STATISTICS

UNITED STATES

		Producer Price Index[1]		Consumer Price Index[2] (1982-1984 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	111.2	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	114.1	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	—	12.52	12.98	12.37	9.88
Jan	1987	100.4	100.5	111.2	—	12.72	12.96	12.17	9.82
Feb	1987	100.8	101.0	111.6	—	12.63	12.80	12.21	9.82
Mar	1987	101.1	101.2	112.1	116.1	12.58	12.76	12.24	9.82
Apr	1987	101.6	101.9	112.7	—	12.51	12.84	12.30	9.81
May	1987	101.9	102.6	113.1	—	12.50	12.87	12.32	9.81
Jun	1987	102.4	103.0	113.5	117.2	12.52	12.88	12.28	9.83
Jul	1987	103.1	103.5	113.8	—	12.41	13.02	12.37	9.86
Aug	1987	103.7	103.8	114.4	—	12.40	13.01	12.33	9.98
Sep	1987	103.5	103.7	115.0	117.8	12.50	13.29	12.56	9.94
Oct	1987	104.0	104.1	115.3	—	12.42	12.99	12.50	9.92
Nov	1987	104.2	104.2	115.4	—	12.54	13.11	12.55	9.98
Dec	1987	104.1	104.1	115.4	118.7	12.60	13.14	12.61	10.03
Jan	1988	104.3	104.5	115.7	—	12.77	13.03	12.55	10.02
Feb	1988	104.6	104.8	116.0	—	12.71	12.96	12.55	10.02
Mar	1988	104.7	104.9	116.5	119.4	12.59	13.17	12.53	10.04
Apr	1988	105.6	105.8	117.1	—	13.08	13.17	12.57	10.09
May	1988	106.1	106.5	117.5	—	12.99R	13.09	12.59R	10.12
Jun	1988	106.5	107.4	118.0	120.6	13.18P	13.12P	12.60R	10.15R
Jul	1988	106.7	107.8	118.5	—	—	—	12.71P	10.20P

P = Preliminary **R** = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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SERVICE LOCATIONS

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NUEXCO REPORT 241 FIGURES OF THE MONTH (August 31, 1988)	This Month (Report 241)	Last Month (Report 240	12 Months Ago (Report 229)
Exchange Value (\$US per pound U_3O_8)	14.15	14.75	16.65
US Premium for the Exchange Value (\$US per pound U_3O_8)	0	0	2.35
UF_6 Value (\$US per kg U as UF_6)	41.00	42.75	47.00
US Premium for the UF_6 Value (\$US per kg U as UF_6)	0	0	6.00
Transaction Value (\$US per pound U_3O_8 equivalent)	15.00	15.45	17.55
Loan Rate (Per Annum)	3.5%	3.5%	4%
Conversion Value (\$US per pound U as UF_6)	1.95	1.85	1.90
Near-Term Uranium Supply[1] (millions of pounds U_3O_8)	7.3	7.9	3.7
Near-Term Uranium Demand[2] (millions of pounds U_3O_8)	1.6	1.7	2.0
Near-Term Supply-Demand Ratio	4.6	4.6	1.8
Recent Uranium Sales:[3]			
Number of Transactions	7	10	6
Quantity of Material (Millions of pounds U_3O_8 equivalent)	6.8	5.0	1.6
Nuexco SWU Value: (\$US per SWU)[3]			
at 0.3 tails assay	65	68	75
US DOE SWU Prices: (\$US per SWU)			
USEC	117.00[4]	117.00[4]	119.00[5]
AFC	153.00[6]	153.00[6]	153.00[6]
Requirements	157.00[6]	157.00[6]	157.00[6]
Incentive Price	90.00[7]	90.00[7]	90.00[7]
Market Value of Enriched UF_6[8]: (\$US per kg U as UF_6)			
2.5 w/o U_{235}	386	401	446
3.0 w/o U_{235}	494	513	570
3.5 w/o U_{235}	603	627	697
4.0 w/o U_{235}	714	742	825

---

[1] Active inquiries to sell, for delivery within 12 months after contract signing.

[2] Active inquiries to purchase, for delivery within 12 months after contract signing.

[3] Uranium sales only; does not include loans, conversion, or SWU transactions.

[4] Effective since 10/1/87.

[5] Effective since 10/1/86.

[6] Effective since 10/1/84.

[7] Effective since 10/1/86, for up to 30% of annual requirements.

[8] Calculated using the Nuexco Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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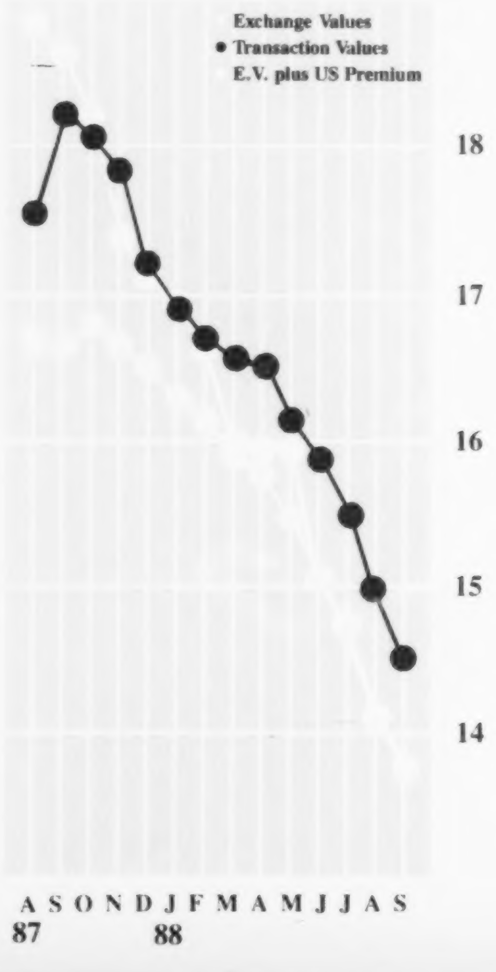

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

October 1988 No. 242

R. GENE CLARK, ***EDITOR*** **FRANCE A. HEAD,** ***ASSOCIATE EDITOR***

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To Our Readers

* * *

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Please make a note that as of September 30, NUEXCO's telephone and telecopier numbers have been changed. The new numbers are:

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NUEXCO
October 1988
No. 242

MARKET VALUES SUMMARY

September 30, 1988	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE[1]	**$13.75**/lb U_3O_8	5,820[2]	974[2]
US Premium[7]	- 0 -		
UF_6 VALUE[2]	**$40.75**/kg U as UF_6	5,820[2]	974[2]
US Premium	- 0 -		
CONVERSION VALUE[3]	**$1.95**/lb U as UF_6	660	2,535
SWU VALUE[4]			
0.3 tails assay:	**$65**/SWU	890	80
LOAN RATE[5]	**3.5%**/annum	2,950	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE[6]	14.50	2.7	17	3

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

[2] For either uranium concentrates or uranium hexafluoride.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

7. The **US Premium** is Nuexco's judgment of the incremental price (relative to the Exchange Value or UF_6 Value, as applicable) at which transactions for significant quantities of natural uranium could be concluded as of the date indicated, if the buyer will accept only US-origin.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers .
4. The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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PRICING

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of September 30, 1988)

The market for U_3O_8 and UF_6 weakened again this month as a result of continued competition for sales opportunities, and trading volume for combined near and long-term transactions declined to 2.4 million pounds U_3O_8 equivalent. Six U_3O_8 transactions, two of which involved long-term deliveries, and two UF_6 transactions were concluded. One secondary conversion market transaction is reported this month, the terms of which were essentially concluded several months earlier. Three SWU transactions occurred, one involving a large quantity of SWU, and one EUP sale was finalized.

The **Exchange Value** dropped to **$13.75** per pound U_3O_8, a decrease of $0.40 from last month, as actual transaction prices declined progressively during the month. Four near-term U_3O_8 transactions involving a total of approximately 370,000 pounds are reported, and additional material remains available at the Exchange Value level, as several utilities received several competitive offers at or near that price level during the month.

Two transactions, involving approximately 1.7 million pounds, are reported for long-term delivery . At least one transaction covering a significant quantity of U_3O_8 for long-term delivery is near completion, and several utilities are expected the enter the market in the next few months for long-term offers.

The **US Premium for U_3O_8** remains at **zero**. The USA has now passed implementing legislation for the US/Canada Free Trade Agreement (FTA), and its fate now lies with Canada. On October 3, Prime Minister Brian Mulroney announced that general elections would take place November 21. The central campaign issue is expected to be the FTA, which has been stalled in the Canadian Senate by the opposition Liberal Party leadership. Although Mr. Mulroney's Progressive Conservative Party currently enjoys a lead over the Liberal and New Democrat parties in public opinion polls, the opposition parties have both promised to scuttle the FTA.

A Gallup Poll conducted the last week of September gave the Conservative Party the support of 40 percent of the decided Canadian public, compared to 31 percent for the New Democrats and 26 percent for the Liberals. If this support persists through the election, the Conservatives are likely to retain their majority in the House of Commons. About a quarter of eligible voters are undecided, and a shift of only a few percentage points in support could leave the Conservatives with a minority of House of Commons seats. Such a minority would make it difficult, if not impossible, for Mr. Mulroney to obtain passage of the FTA's implementing legislation, in view of the stated opposition of the other parties.

It is expected to be a bitter campaign, with the opposition parties painting the FTA as a sellout of Canada's sovereignty. For example, Liberal Party leader John Turner accused Mulroney of signing over "the sovereignty and independence of our nation" through the FTA, which would "make us nothing more than a junior partner and, even, a colony of the United States". Mulroney's campaign strategy seems to be to play down the FTA, presenting it as part of a broader record of accomplishment in economic, social, and foreign policy for his Administration.

Potentially tied to the fate of the FTA is the attempt by the US uranium industry, through the US courts and Congress, to obtain enforcement of Section 161v of the US Atomic Energy Act, in order to restore the US uranium industry's viability by limiting imports. If the FTA is approved by Canada (now that the USA has approved it), the US Producers' Lawsuit against the DOE is probably moot, since the FTA exempts Canada from any restrictions on enriching imported uranium that might result from the lawsuit. On the other hand, if the FTA fails to win approval in Canada, the lawsuit may come to the forefront of US uranium producer efforts.

Although the US Supreme Court ruled against the producers on one narrow point of the lawsuit, the case is currently remanded back to the District Court for findings on whether the US uranium industry could be made viable through restrictions on DOE's enriching imported uranium for US end use. Judge Jim Carrigan of the District Court is scheduled to meet with attorneys for the producers and DOE on October 13 to set a trial date for this next phase of the lawsuit.

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Active supply of natural uranium (concentrates and UF_6) for spot delivery totals **5.3 million pounds** U_3O_8 equivalent, a decrease of approximately two million pounds since last month. **Active demand** for natural uranium also declined to approximately **1.0 million pounds**, compared to 1.6 million pounds the previous month. The **supply/demand ratio**, rounded up, is **6.0 to 1**.

* * *

The **Transaction Value** fell by $0.50 to **$14.50** per pound U_3O_8, as a result of the effect of recent lower-priced transactions in the calculation. Extending over a three month period, the calculation includes 17 transactions involving approximately 2.7 million pounds U_3O_8 equivalent.

* * *

The **UF_6 Value** decreased to **$40.75**, down $0.25 since last month. Two natural UF_6 transactions involving a total of less than 300,000 pounds U_3O_8 equivalent are reported. Active demand declined by 40 percent over the month, and a major UF_6 supplier has been less active in the market as a consequence of organizational changes. The degree to which this supplier actively participates in the spot market will significantly impact future UF_6 prices. Demand remains weak, although two utilities are expected to solicit offers for UF_6 at the beginning of the month. The **US Premium for UF_6** remains at **zero**.

* *

The **Loan Rate** is unchanged at **3.5 percent** per annum, and no loan transactions are reported.

The **Conversion Value** is unchanged at **$1.95** per pound U as UF_6, and one transaction which was essentially concluded several months ago is reported to fall in the 92-97 percent range of the current Conversion Value, consistent with the Conversion Value at that time. A sharply altered supply/demand ratio has increased the prospect of higher prices in the secondary market for conversion services. The availability of fewer deconversion swap transactions has reduced prospective supply, even as a number of utilities are entering the market to cover substantial near and longer-term unfilled requirements, some of which may be filled in the secondary conversion market.

* * *

ENRICHMENT SERVICES AND SWU

The **SWU Value** remains at **$65** per SWU. Four transactions took place, two of which involved quantities of less than 50,000 SWU each. One transaction involving enriched uranium product and another involving a large quantity of SWU were concluded at prices evaluated to be at or near the current SWU Value.

The SWU market has been fairly active over the last several months. One holder of excess DOE SWU was able to dispose of it at relatively competitive prices through a number of small sales over the spring and summer. In addition, larger sales opportunities caused supplies to emerge at very competitive prices, and was a factor in the recent SWU Value decline, from $73 in early 1988 to $65 at present. These supplies are expected to remain in the market, although no significant demand is likely to appear until early next year. Any spot SWU transactions in 1988 will undoubtedly be for delivery well into 1989.

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US LEGAL AND POLITICAL DEVELOPMENTS
SEPTEMBER 1988

Sept. 6 A Federal Appeals Court ruled that the Nuclear Regulatory Commission (NRC) may accept emergency evacuation plans developed by utilities in the absence of their formulation by state and local governments. Litigation arose after Massachusetts Governor Michael Dukakis refused to allow local and state participation in emergency planning for the Seabrook nuclear plant. The ruling may facilitate licensing of other plants which are currently blocked by similar opposition. Since 1980, the NRC has licensed eight plants where state or local governments have refused to participate in emergency plans.

Sept. 14 The Senate Foreign Relations Committee approved the Anti-Apartheid Act Amendment of 1988 (S.2756) by a vote of 10 (Democrats) to 9 (Republicans). The bill is unlikely to reach the Senate floor this session due to time constraints and insufficient support.

Sept. 16 Clearing a major roadblock to Seabrook licensing, the NRC amended its emergency planning regulations to allow operations at up to five percent power at nuclear plants even if emergency sirens are not in place. Sirens placed in some areas near the plant had been dismantled by intervenors.

Sept. 16 The New York State Public Service Commission and the Internal Revenue Service approved the plan to scrap the Shoreham nuclear plant. The State Legislature must still endorse the proposal before it is finalized.

Sept. 19 The US Senate passed the US/Canada Free Trade Agreement (FTA) implementing legislation by a vote of 83 to 9, completing its approval process in Congress.

Sept. 28 President Reagan signed legislation implementing the FTA.

CANADIAN POLITICAL DEVELOPMENTS
OCTOBER 1988

Oct. 2 Prime Minister Brian Mulroney dissolved the Canadian Parliament and scheduled a general election for November 21. The central campaign issue is expected to be the FTA, which has been stalled in the Canadian Senate by the opposition Liberal Party leadership. If Mulroney's Progressive Conservative Party retains its majority in the House of Commons, the FTA will pass; however, the opposition parties, if elected, will scuttle the FTA.

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
	This Month (Sept 30, 1988)	Last Month (Aug 31, 1988)	12 Months Ago (Sept 30, 1987)	This Month (Sept 30, 1988)	Last Month (Aug 31, 1988)	12 Months Ago (Sept 30, 1987)
Australia (dollar)	17.57	17.57	23.16	45.67	45.67	60.20
Belgium (comm. franc)	542.19	554.03	635.74	1,410	1,440	1,652
Canada (dollar)	16.75	17.50	21.83	43.56	45.49	56.75
EEC (ecu)	12.47	12.75	14.75	32.42	33.16	38.34
Finland (markka)	61.06	62.64	73.48	158.73	162.85	191.02
France (franc)	88.08	89.61	101.96	229.00	232.98	265.07
FRG (mark)	25.88	26.41	30.63	67.29	68.66	79.64
Italy (lira)	19,266	19,598	22,112	50,087	50,951	57,485
Japan (yen)	1,847	1,910	2,437	4,803	4,964	6,335
Netherlands (guilder)	29.17	29.81	34.48	75.83	77.51	89.64
South Africa (rand)	34.13	34.37	34.51	88.72	89.35	89.71
Spain (peseta)	1,712	1,748	2,026	4,451	4,544	5,268
Sweden (krona)	88.65	91.17	107.07	230.48	237.03	278.37
Switzerland (franc)	21.91	22.30	25.46	56.97	57.98	66.19
UK (pound)	8.17	8.38	10.22	21.23	21.78	26.58
US (dollar)	13.75	14.15	16.65	35.75	36.79	43.29

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 as Concentrates			per kg U as Concentrates		
	This Month (Sept 30, 1988)	Last Month (Aug 31, 1988)	12 Months Ago (Sept 30, 1987)	This Month (Sept 30, 1988)	Last Month (Aug 31, 1988)	12 Months Ago (Sept 30, 1987)
Australia (dollar)	18.52	18.62	25.31	48.16	48.41	65.81
Belgium (comm. franc)	571.77	587.31	694.92	1,486	1,527	1,807
Canada (dollar)	17.67	18.55	23.86	45.93	48.22	62.03
EEC (ecu)	13.15	13.52	16.12	34.18	35.15	41.91
Finland (markka)	64.39	66.40	80.32	167.39	172.63	208.81
France (franc)	92.89	95.00	111.45	241.49	246.97	289.75
FRG (mark)	27.30	28.00	33.49	70.97	72.78	87.06
Italy (lira)	20,317	20,776	24,170	52,819	54,012	62,837
Japan (yen)	1,948	2,024	2,664	5,065	5,263	6,925
Netherlands (guilder)	30.76	31.61	37.69	79.97	82.17	97.98
South Africa (rand)	35.99	36.43	37.72	93.56	94.72	98.06
Spain (peseta)	1,805	1,853	2,245	4,693	4,817	5,758
Sweden (krona)	93.49	96.65	117.04	243.05	251.27	304.28
Switzerland (franc)	23.11	23.64	27.83	60.07	61.46	29.05
UK (pound)	8.61	8.88	11.18	22.39	23.09	27.93
US (dollar)	14.50	15.00	18.20	37.70	39.00	47.32

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb U as UF_6			per kg U as UF_6		
Country (currency)	**This Month (Sept 30, 1988)**	**Last Month (Aug 31, 1988)**	**12 Months Ago (Sept 30, 1987)**	**This Month (Sept 30, 1988)**	**Last Month (Aug 31, 1988)**	**12 Months Ago (Sept 30, 1987)**
Australia (dollar)	2.49	2.42	2.64	5.49	5.34	5.83
Belgium (comm. franc)	76.89	76.35	72.55	169.52	168.32	159.94
Canada (dollar)	2.38	2.41	2.49	5.24	5.32	5.49
EEC (ecu)	1.77	1.76	1.68	3.90	3.87	3.71
Finland (markka)	8.66	8.63	8.38	19.09	19.03	18.49
France (franc)	12.49	12.35	11.64	27.54	27.23	25.65
FRG (mark)	3.67	3.64	3.50	8.09	8.02	7.71
Italy (lira)	2,732	2,701	2,523	6,024	5,954	5,563
Japan (yen)	261.99	263.16	278.06	577.59	580.16	613.02
Netherlands (guilder)	4.14	4.11	3.93	9.12	9.06	8.67
South Africa (rand)	4.84	4.74	3.94	10.67	10.44	8.68
Spain (peseta)	242.78	240.86	231.23	535.23	531.00	509.77
Sweden (krona)	12.57	12.56	12.22	27.72	27.70	26.94
Switzerland (franc)	3.11	3.07	2.91	6.85	6.78	6.40
UK (pound)	1.16	1.15	1.17	2.55	2.55	2.57
US (dollar)	1.95	1.95	1.90	4.30	4.30	4.19

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	SWU Value at 0.30% Tails Assay This Month (September 30, 1988)	**SWU Value at 0.30% Tails Assay Last Month (August 31, 1988)**	**UF_6 Value per kg U as UF_6 This Month (September 30, 1988)**	**UF_6 Value per kg U as UF_6 Last Month (August 31, 1988)**
Australia (dollar)	83.04	80.70	52.05	50.90
Belgium (comm. franc)	2,563	2,545	1,607	1,605
Canada (dollar)	79.20	80.38	49.65	50.69
EEC (ecu)	58.94	58.58	36.95	36.95
Finland (markka)	288.63	287.74	180.95	181.49
France (franc)	416.40	411.65	261.05	259.65
FRG (mark)	122.36	121.31	76.71	76.52
Italy (lira)	91,075	90,028	57,097	56,787
Japan (yen)	8,733	8,772	5,475	5,533
Netherlands (guilder)	137.89	136.96	86.44	86.38
South Africa (rand)	161.33	157.88	101.14	99.58
Spain (peseta)	8,093	8,029	5,073	5,064
Sweden (krona)	419.08	418.81	262.73	264.17
Switzerland (franc)	103.59	102.44	64.94	64.61
UK (pound)	38.61	38.48	24.20	24.27
US (dollar)	65.00	65.00	40.75	41.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

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RECENT TRANSACTIONS[1]

URANIUM SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Exchange or UF_6 Value[2]	Seller	Buyer	Remarks
4372	1988	less than 50	98-102	Intermediary	Utility	US Origin
4373A	1989	50-100	See Remarks	Intermediary	Utility	Contained in Low-Enriched Uranium
4376	1988	50-100	103-107	Producer	Intermediary	US Origin
4381	1988	less than 50	98-102	Intermediary	Utility	UF_6
4383	1988	101-300	98-102	Intermediary	Utility	
4384	1991-95	1,001-1,500	See Remarks	Producer	Utility	Base-Price Escalated
4385	1992-95	301-500	See Remarks	Producer	Utility	Market-Related Pricing
4388	1988	101-300	98-102	Intermediary	Utility	UF_6
4389	1988	50-100	98-102	Intermediary	Utility	US Origin

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

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CURRENT MARKET DATA

LOAN TRANSACTIONS

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price Range as Percent of Current Loan Rate	Lender	Borrower	Remarks

No loan transactions are reported this month.

CONVERSION SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price Range as Percent of Current C.V.	Seller	Buyer	Remarks
4382	1988	101-300	93-97	Intermediary	Utility	

ENRICHMENT SERVICES SECONDARY MARKET SALES

Nuexco Transaction Number	Delivery Period	Approximate Quantity[4] (thousands of SWU)	Approximate Price Range as Percent of Current SWU Value[5]	Seller	Buyer	SWU Origin	Remarks
4369	1988	less than 50	108-112	Intermediary	Utility	DOE	
4373B	1989	less than 50	See Remarks	Intermediary	Utility		Contained in Low-Enriched Uranium
4375	1988	less than 50	108-112	Intermediary	Intermediary	DOE	
4386	1990-92	101-300	98-102	Intermediary	Utility		

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Where US-origin material is involved, the range is based on the Exchange Value (or UF_6 Value) *plus* the premium (relative to the Exchange Value or UF_6 Value). The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation R means that Nuexco either does not know, or that Nuexco has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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URANIUM SUPPLY

(September 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	 Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
87-1002	270	—	1988
87-1068A	1,000	—	1988, UF_{6e}
87-1123	1,000	1,000 per year	1989 on
87-1141	500	200 per year	1989-92
88-1000A*	250	—	1988
88-1000B	200	—	1988, UF_6
88-1001	200	—	1988
88-1036	100	—	1988
88-1078	1,200	—	1988
88-1153	100	—	1989
88-1157	1,000	1,000 per year	1989 on, UF_6
87-1000*	—	500 per year	1990-93
87-1001	—	500 per year	1989 on
87-1005	—	250 per year	1989-95
87-1061	—	700 per year	1989 on
Total	**5,820**		
INACTIVE			
87-1019	1,000	1,000 per year	1988-91
87-1053	100	500 per year	1989 on
88-1026	250	—	1988
88-1033A	130	—	1988, UF_{6e}
87-1130	—	580	1989
88-1064*	—	250 per year	1990-95
88-1096A	—	290	1990, UF_{6e}
Total:	**1,480**		

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 88-1041, 88-1122, 88-1155.

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URANIUM DEMAND

(September 30, 1988)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
87-1154A	44	—	1988, UF$_6$e
88-1115	325	—	1988
88-1148*	75	—	1988, UF$_6$
88-1151	100	—	1988, UF$_6$
88-1154*	250	—	1989
88-1163*	100	—	1988, UF$_6$
88-1179*	80	—	1988
87-1021*	—	100 per year	1992-99
88-1089	—	1,200 per year	1990-95
88-1107A	—	100	1989, UF$_6$e
88-1161*	—	500+ per year	1993-98
88-1180*	—	200 per year	1991-95
Total:	**974**		
INACTIVE			
88-1084*	800	—	1989-94
88-1103*	250	—	1939
88-1159*	260	—	1989, UF$_6$
87-1134*	—	150	1989-90, U_3O_8/UF$_6$
Total	**1,310**		

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 88-1126, 88-1133, 88-1144, 88-1147, 88-1149A, 88-1156.

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LOAN SUPPLY AND DEMAND
(September 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1012	1,000	—	U_3O_8
87-1031*	1,000	—	U_3O_8
87-1157*	500	—	U_3O_8
88-1135*	300	—	U_3O_8
88-1139	150	—	U_3O_8
Total:	**2,950**		
INACTIVE			
87-1033	1,000	—	U_3O_8
Total:	**1,000**		

Available to Borrow:

No inquiries to borrow are reported.

* New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 88-1057

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(September 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
ACTIVE			
88-1181*	660	—	1989-90
Total	**660**		
INACTIVE			
87-1008	770		1988
Total:	**770**		
Inquiries to Purchase			
ACTIVE			
88-1034*	110	5,000	1990-95
88-1158*	425	1,000 per year	1989-93
88-1178*	2,000	3,000 per year	1990-92
Total:	**2,535**		
INACTIVE			
88-1113*	660	—	1989
88-1169*	340	—	1988-89
Total:	**1,000**		

* New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 88-1021, 88-1127.

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SWU SUPPLY AND DEMAND
(September 30, 1988)

Nuexco Project Number	Delivery Period[1] (Thousands of SWU) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
87-1068B	250	—	1988, UF_6e
88-1065	500		1990, UF_6e
88-1138*	140	140 per year	1989-95
Total	**890**		
INACTIVE			
87-1128	360	—	1988
88-1033B	15	—	1988, UF_6e
88-1082	25	—	1988
88-1096B*		55	1990, UF_6e
Total:	**400**		
Inquiries to Purchase			
ACTIVE			
87-1154B	10	—	1988, UF_6e
88-1085	10	—	1988
88-1107B	60	—	1989, UF_6e
88-1077	—	70	1989-91
Total:	**80**		
INACTIVE			
None reported			

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 87-1058, 88-1149B.

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FEDERAL REPUBLIC OF GERMANY (FRG)

Pro-Nuclear Bavarian Premier Dies

Franz Josef Strauss, Premier of Bavaria since 1978, died on October 3, 1988 at the age of 73. Strauss had been Chairman of the Christian Social Union (CSU), the Bavarian sister party of Chancellor Helmut Kohl's Christian Democratic Union (CDU), since 1961. In conjunction with the Free Democratic Party (FDP), headed by Hans-Dietrich Genscher, the CSU and CDU constitute the current coalition government in the country. Strauss was one of the most outspoken advocates of the FRG nuclear program, and his presence, particularly in view of rising anti-nuclear factions, will be missed. He endorsed the Wackersdorf reprocessing plant in Bavaria and had been campaigning for its completion.

* * *

Operating License Revoked for Muelheim-Kaerlich

On September 9, the FRG's Superior Administrative Court in Berlin revoked the partial operating license of Rheinisch-Westfaelisches Elektrizitaetswerk AG (RWE) for its PWR at Muelheim-Kaerlich. The only nuclear reactor in the State of Rheinland-Palatinate was shut down on the grounds that safety issues were improperly addressed during the licensing process. As a result, RWE must now reapply for an operating license — an expensive and lengthy process. Nuclear sentiment in Rheinland-Palatinate apears to be more favorable than in Schleswig-Holstein, however, which may be a factor in expediting the reactor's startup.

This is the second time Muelheim-Kaerlich has been shut down on procedural grounds; the first was in October 1986 for improper procedures followed in licensing cooling towers. Intervenors were responsible for the court actions on both occasions and have filed more than 5000 separate actions since 1975. Over the past 12 years, RWE has lost millions of dollars from licensing delays even though the complaints were filed against the licensing officials —not RWE.

* * *

Use of MOX Fuels Delayed by SPD

The SPD has also been instrumental in halting and preventing the use of mixed-oxide (MOX) assemblies in the three Schleswig-Holstein nuclear reactors. In August, Preussenelektra was unable to complete a planned reload of four MOX assemblies at Brokdorf because of opposition from Minister of Energy and Social Affairs Guenther Jansen who barred the use of any MOX assemblies containing plutonium of different origins. (The planned Brokdorf reload apparently contained plutonium reprocessed at two different facilities.)

Hamburgische Electricitaets-Werke Ag (HEW), admittedly influenced by SPD tactics, recently decided to postpone using MOX fuels at the other two State reactors—Bruensbuettel and Kruemmel.

The delays will set back the West German national plutonium recycling program which calls for the drawdown of the national plutonium stockpile, stored by Siemens in Hanau, by 1995. At that time, additional plutonium, which will have been reprocessed at Cogema's UP-3 facility scheduled for startup in 1989, will be added to inventory.

The SPD-imposed roadblocks to the national program are also in direct violation of the German Atomic Act which provides for a closed fuel cycle. Consequently, the ban against MOX fuel usage may be short-lived.

More than one-third of the MOX assemblies (456 assemblies) scheduled for reload through 1995 are for the three Schleswig-Holstein reactors. Only Brokdorf is currently licensed to load recycled fuel.

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Federal Order Allows Brokdorf Operation

Overruling state nuclear officials for the first time, Federal Minister of Environment and Nuclear Safety (BMU) Klaus Toepfer ordered on August 26 the resumption of operations at the 1250-MWe Brokdorf PWR located in Schleswig-Holstein.

Alleging safety concerns, Guenther Jansen, Minister of Energy and Social Affairs for the newly-elected Social Democrat (SPD) government in Schleswig-Holstein, blocked the restart of the Brokdorf unit, which was shut down July 1, 1988 for its first refueling. Several fuel assembly spacer pieces as well as some centering guide pins broke off during refueling and were assumed to have fallen into the reactor core.

According to the Northern German Technical Inspection Association (TUeV) and the Society for Reactor Safety (Gesellschaft für Reaktorsicherheit), these problems posed no threat to safe operations and provided insufficient justification for barring the reactor's startup. Preussenelektra AG, the majority owner (80 percent) of Brokdorf, said that similar breakage incidents had occurred numerous times in other FRG reactors and had never before stalled operations.

Preussenelektra estimates that the unexpected 22-day downtime cost it approximately US $3,500,000 (or $160,000/day) for replacement power, and the utility has considered filing for damages. The Brokdorf unit currently provides approximately 25 percent of Preussenelektra's baseload power.

The SPD gained a majority in the Schleswig-Holstein elections last May, pledging to close down all nuclear power plants in the State (See NUEXCO Report No. 238). It is believed that Jansen had hoped to further SPD nuclear phase-out objectives by demonstrating the dispensability of Brokdorf while it was idled. The reactor's expendability will be difficult to substantiate, however, since electricity sales in Schleswig-Holstein were more than double the Federal average in 1987.

* * *

FINLAND

Industrial Sector Supports Additional Nuclear Plants

In anticipation of the 1991 elections, representatives from Finland's energy-intensive industrial sector (which is one of the world's greatest energy consumers per unit of output) are garnering support for the commissioning of additional nuclear power plants.

Following Chernobyl, public opposition grounded plans for construction of a fifth nuclear reactor in Finland, and the coalition government that was elected in 1987 deferred consideration of any new nuclear units until the end of its four-year term. However, Finland's new atomic energy act which went into effect March 1, 1988, provides parliament rather than the ruling government with the power to approve new nuclear plants, although, in order to proceed, parliament must have the support of local authorities at the proposed plant site.

The paper and pulp companies, many of which own small power plants that use combinations of industrial waste, coal, oil, and peat, are among nuclear energy's current supporters. In addition, the Trade and Industry Minister has recommended adding a new nuclear plant before the end of the century. Based on Finland's projected annual growth rate in power demand of three to four percent through the year 2000, an additional capacity of 2200 MWe will be needed by the turn of the century.

Of Finland's four nuclear units, Imatran Voima Oy (IVO) operates two 430-MWe PWRs located at Loviisa on the south coast between Helsinki and the Russian border. The two Swedish-designed 710-MWe BWR's on the west coast at Olkiluoto are operated by Teollisuuden Voima Oy (TVO).

Finland has one of the safest and most efficient nuclear reactor operating records in the world and, in 1987, reported an average load factor of 92.1 percent. The same year, nuclear energy provided approximately 37 percent of all electricity generated in Finland.

* * *

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REPUBLIC OF SOUTH AFRICA

South Africa Averts IAEA Suspension

The Republic of South Africa avoided expulsion from the International Atomic Energy Agency (IAEA) by expressing its "objective and desire" (as opposed to its "hope" a year earlier) to sign the Nuclear Nonproliferation Treaty (NPT), provided some of its "concerns" could be alleviated. At its 32nd General Conference held in September 1988, the IAEA approved a resolution proposed by Egypt on behalf of the African States requesting Director General Hans Blix to "continue to take all possible measures" to encourage South African compliance with IAEA safeguards, and to review the situation again in September 1989. The resolution passed by a vote of 58 for, 29 against (the OECD countries and Israel), and 4 abstaining.

South Africa's refusal to comply with full-scope IAEA safeguards has long been a contentious issue, and the IAEA has pressed South Africa to sign the NPT since all NPT signatory countries are required to submit their nuclear facilities to IAEA inspection. Although South Africa permits two of its nuclear installations—the Koeberg plant near Cape Town and the Safari I nuclear research station near Pretoria—to undergo IAEA inspection, it is the semi-commercial enrichment plant at Valindaba that is the focal point of international concern, because it allegedly is capable of producing weapons-grade material. According to South Africa, Valindaba has not yet commenced commercial operations, although it is eventually expected to produce 300,000 SWU per year.

It is unlikely that South Africa will sign the NPT in the near future unless it receives some guarantee:

- that international trade sanctions against South African-origin uranium imports will be lifted, enabling it to compete freely in the international marketplace like other NPT signatories, and
- that it will be allowed to share the peaceful nuclear technology of the Nuclear Weapon States (USA, UK and USSR) in accordance with Article IV of the NPT. The transfer of peaceful nuclear technology is currently limited by United Nation resolutions which ban all nuclear cooperation with South Africa.

Under the current international political climate, as long as apartheid remains in force, there appears little chance for removal of South African trade sanctions. Unless South Africa independently resolves its concerns, its IAEA membership is likely to become increasingly tenuous. ■

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A MODEST BUT STABLE US URANIUM INDUSTRY

By George White, Jr. & Treva E. King

Following is an edited version of the paper presented by George White, Jr. at the Thirteenth Annual Symposium of the Uranium Institute in London on September 8, 1988.

In 1978 a consensus estimate of 1988 WOCA uranium requirements was about 77,000 tonnes U (MTU), with US requirements estimated at 31,000 MTU. At that time, these estimates were viewed as being very conservative — a low case scenario that took full account of the overly optimistic forecasting so prevalent in previous years. These "very conservative" estimates turned out, however, to be wildly optimistic themselves. Actual 1988 consumption will only be about 42,000 MTU for WOCA, and only 15,000 MTU in the USA. Production forecasts, both for WOCA and the USA, were equally in error. As a consequence, this paper, which focuses on US production, will proceed with an appropriate extra degree of caution.

Before dealing with the "when", the "how much" and the "circumstances" of future US uranium production, I suggest the following as realistic, non-argumentative boundaries for our discussion.

- US uranium consumption is not growing; US consumption, now 15,000 MTU, will average only about 16,000 MTU annually through the year 2000.
- With a few obvious exceptions, US uranium deposits are smaller, lower grade, and more costly to produce than those in Canada, Australia, and Africa.
- US uranium resources are adequate, however, given sufficient price incentive, to supply 100 percent of US needs by 1993.
- There are almost no conceivable circumstances under which US production would exceed US consumption (or about 16,000 MTU annually).
- The actual level of US uranium production will be a function of commercial as well as legislative, political, judicial, and/or other non-commercial developments in the US and other supplying nations, over which US market participants will have little, if any, control.

Before focusing on supply, let me touch briefly on the matter of US uranium consumption. That annual US consumption will plateau at about 16,000 MTU, simply reflects the fact that there are no new reactors planned or being built in the USA. If anything, this projected level of demand is optimistic. Reactor cancellations or retirements, fuel improvements, and the lower tails assays associated with lower SWU prices and/or laser enrichment all suggest reduced uranium usage that almost surely will pre-date increased demand associated with any new reactor orders.

As regards US production, I would state my basic thesis as follows:

> In the free market environment that is expected to prevail in the USA, US production is expected to stabilize at approximately 40 percent of US consumption, or about 6,500 MTU annually.

In the context of this paper and so far as US market participants are concerned, a "free market environment" is one in which there are no origin restrictions or where any existing restrictions do not lead to premium prices for US-origin uranium as a consequence of the need to procure such material sooner or in greater amounts that would be the case, absent such restrictions. While this may seem obvious, it should be noted that an "effective" free market can exist with restrictions.

In this regard, it is a generally held view and, I believe, demonstrably true that no significant price premium for US-origin uranium can be sustained unless government-imposed import restrictions result in the requirement that more than 50 percent of US consumption be filled by US uranium on a continuing basis. Or, stated positively, if import restrictions are to be effective in forcing a price premium for US-origin uranium, such restrictions must, at a minimum, result in US production exceeding 8,000 MTU annually.

The bases for our expectation of a free market environment in the US are these:

- From a practical standpoint, the June 1988 Supreme Court ruling in favor of DOE effectively ended any chance that Section 161(v) of the Atomic Energy Act will be issued as a vehicle to prohibit imports of non-US origin uranium for use in US reactors prior to resolution of the FTA issue. While most observers agree that the US producers would eventually prevail in this case, given the time to see it through to its final conclusion, other events will likely moot such an effort.
- The principal such event is the passage of the US/Canada Free Trade Agreement, without any special language to support or protect the US uranium production industry.
- Finally, there seems to be little chance that the US Congress will pass legislation in the foreseeable future to support or protect the US uranium industry. The requisite political support simply does not appear to exist.

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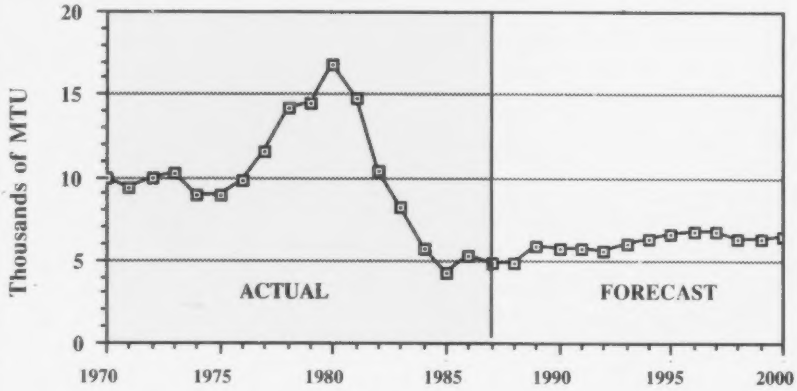
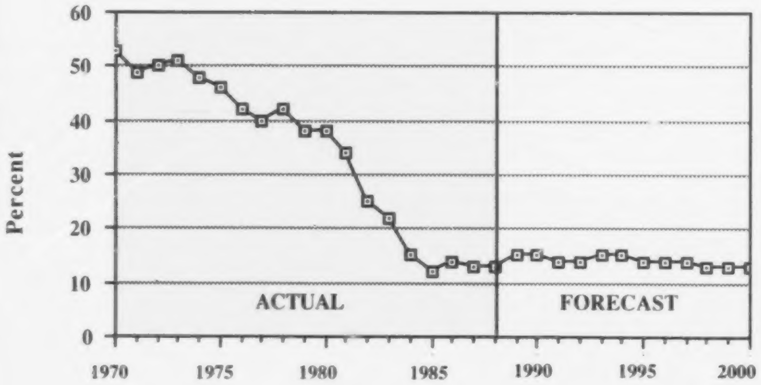
Our belief that US production will stabilize at about 6,500 MTU annually results from analysis of a number of related factors including: forecasts of demand and requirements, existing contractual commitments, uranium production cost estimates, price projections, origin preferences, and expected political developments in producing nations.

Figure 1
US URANIUM PRODUCTION



To begin, Figure 1 depicts the history of US uranium production from 1970 to 1987, as well as our projection through the year 2000. Of greater interest and perhaps more instructive is Figure 2 which illustrates historical and projected US production as a percentage of WOCA production. What is most clear is the erosion of the once-dominant US position. From 53 percent in 1970, the US share of WOCA production slipped to 46 percent by 1975, and to 38 percent by 1980, before plummeting to 12 percent in 1985. And, in the projected free market case, we see that US production will stabilize in the range of 13 to 15 percent of WOCA through the year 2000.

Figure 2
USA AS A PERCENT OF
WORLD URANIUM PRODUCTION



Between 1980 and 1985 alone, US production dropped by about 75 percent from 16,800 to 4,300 MTU. What happened? Having expanded in response to prices of $40 per pound U3O8, the US industry collapsed when prices subsided to the sub-$20 level. In 1980, total WOCA production was 44,200 MTU, with 16,800 from the USA and 27,400 from other nations. In 1985, WOCA production was only 35,000 MTU, 9,200 less than in 1980. But the US total declined 12,500 MTU (from 16,800 to 4,300), while the rest of the nations increased their aggregate share by some 3,300 MTU (from 27,400 to 30,700). This is a classic example of inefficient, high-cost production being displaced by more efficient, lower-cost production. In fact, some US producers shut down operations in favor of meeting their delivery commitments with uranium which they were able to purchase in the open market at prices below their own costs of production.

In this free market scenario, US uranium production will comprise three main elements between now and the year 2000:

- conventional production, dominated by higher grade underground mines;

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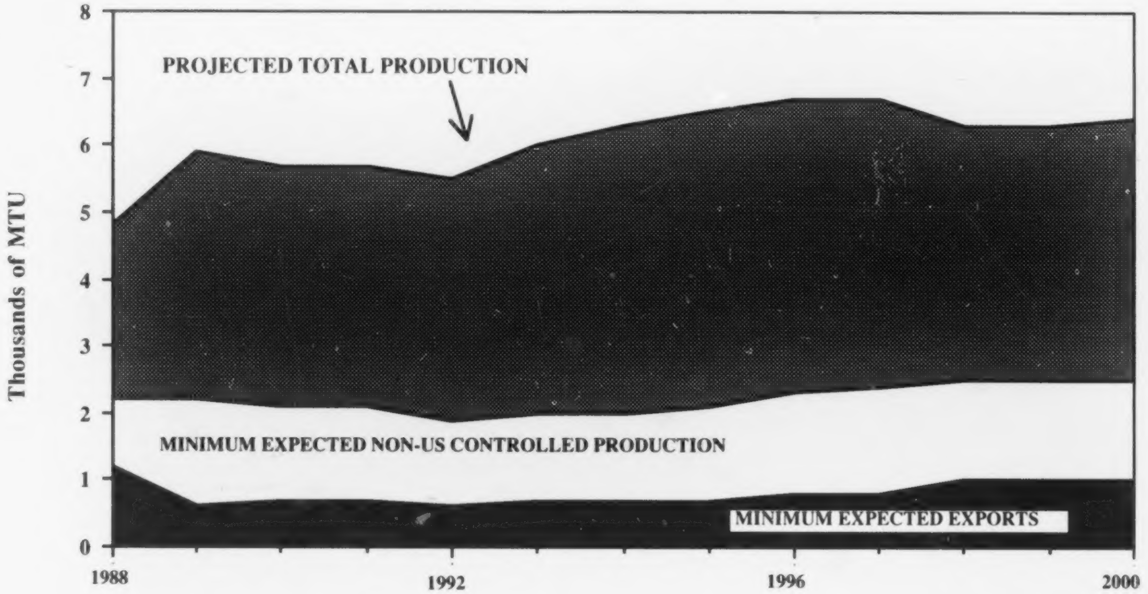
Figure 3
TOTAL PROJECTED US PRODUCTION, NON-US CONTROLLED PRODUCTION, AND EXPORTS OF URANIUM



- increased output from an expanding group of in-situ producers;
- a gradual shutdown of high-cost production, including most by-product operations, as current contracts expire.

Mines and mills, currently shutdown or on standby, are unlikely to reopen — the victims of high costs, environmental considerations, and deteriorating facilities. Overall, production emphasis in the USA will increasingly switch to smaller, more flexible, and lower-cost operations.

However, the future of the US uranium industry is not near as bleak as might be inferred from a first inspection of Figure 2. In fact, changes that will contribute to stabilizing the US industry are already well underway. First and foremost has been the emergence of a number of non-US organizations which, by their actions, have demonstrated that they view the USA as an important source of long-term uranium supply. To wit:

- RTZ's Rio Algom unit has been a long-time US producer.
- Cogema's recent purchase of a controlling interest in Saarberg Interplan has expanded a US position that started with the purchase of Pathfinder.
- Total, the other French connection, has two existing US operations and is reportedly looking at further acquisitions.
- Three Swiss utilities have long-time relationships with Energy Fuels' Arizona Strip operations.
- Korean and German interests have acquired important equity positions in Nebraska's Crow Butte deposit.
- CEGB has uranium supply contract with two US producers and also holds property interests in Wyoming.

Though not exhaustive, this list suffices to make the point.

This foreign involvement in the US market is reflected in Figure 3 which shows total projected US production together with both the portion to be exported by US producers and the portion controlled by non-US entities. These data demonstrate our expectation that non-US entities will continue to play a significant role in the US

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uranium industry—both as purchasers and owners. Based on recent developments, however, I judge that we may still be underestimating the degree of control that will be exercised by such non-US organizations.

Why this apparently growing interest in obtaining US supply and investing in US resources when less costly production is obviously available elsewhere, and US companies themselves appear discouraged? Reasons include:

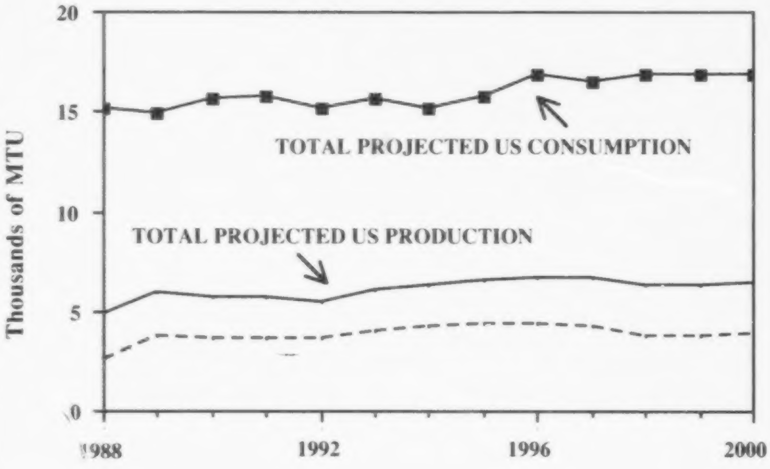
- For the most part, the foreign groups active in the US represent countries lacking indigenous resources and, consequently, are more sensitive to assurance and diversity of supply considerations.
- From a political standpoint, the US represents the single most reliable source of uranium supply. Unlike Australia and Canada, there are no foreign investment limitations or considerations and no provisions for government oversight, approval, or interference in the commercial terms and conditions that may be negotiated between buyers and sellers.
- Technological advances, particularly in the field of in-situ leaching, have reduced production costs of some US deposits to more competitive levels. Further, obtaining this technology has become an end in itself.
- The weakened US dollar has created a unique window of opportunity for foreign investors and buyers, just at the time that numerous properties and projects in the USA are available as a consequence of decisions by domestic organizations to leave the uranium business.

In addition and reacting to these circumstances, some US producers have adopted more aggressive and apparently successful, internationally-oriented marketing strategies, seeking buyers who are concerned more with supply assurance than the current level of spot prices. Indeed, while many may disagree, others would argue that it is this very preoccupation with the spot market and spot market pricing that is a primary cause of the boom/bust cycles that have characterized the history of the uranium industry.

Returning to the production equation, and given the projected, relatively stable level of US production, it is a simple matter to calculate that portion of US demand that will be supplied by non-US sources. Figure 4 compares projected US consumption and production. The upper area represents the market available to non-US suppliers, and totals nearly 130,000 MTU through the year 2000. Note that US production is divided into two segments. The upper one represents that portion of US production projected to be exported, plus that portion of US production that is controlled by non-US entities and is, presumably, most available for export. Were all this material, in fact, exported, nearly 155,000 MTU of non-US origin material would be needed to satisfy US requirements.

Quantifying total US imports is not difficult. Predicting the specific sources of those imports is quite another matter. It is, however, possible to offer certain observations with some degree of confidence. For the foreseeable future, Canada will continue to dominate; its share of the US market could easily grow to or exceed 40 percent, or about 6,400 MTU annually. Canada's principal competition will come from increasingly aggressive Australian suppliers. Others who could potentially play major roles in the US market include: Namibia (provided the political situation there is resolved in a manner acceptable to the US government), China (assuming no

Figure 4
TOTAL PROJECTED US URANIUM PRODUCTION AND CONSUMPTION



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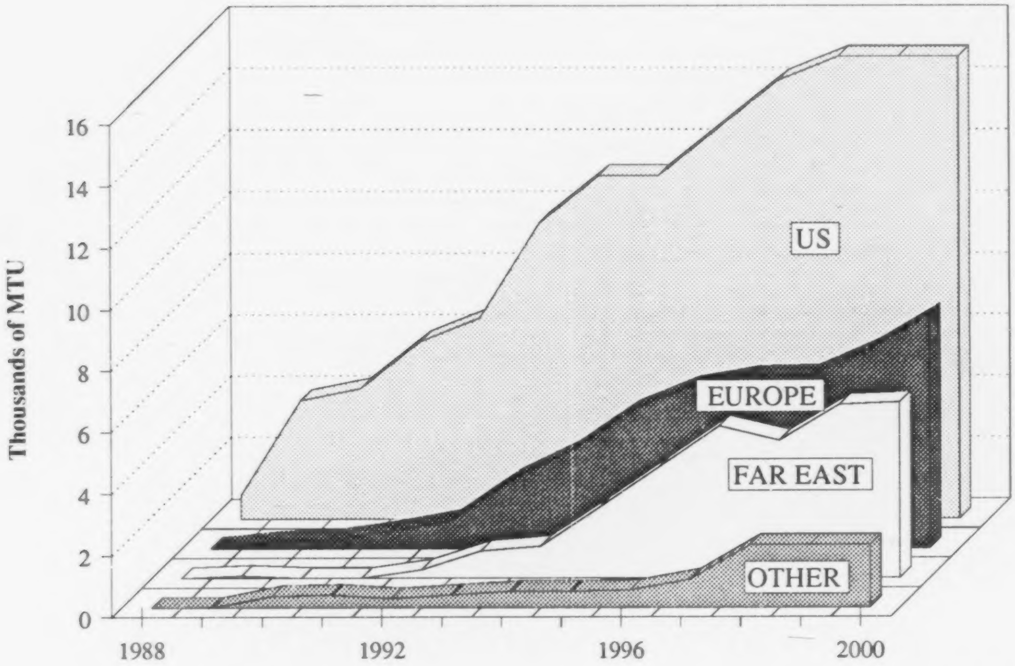
change in its currently-enunciated decision to become a world class supplier), and Russia (particularly as a seller of enriched product).

While the US uranium production industry will never return to its former dominance, the unfilled uranium needs of the US nuclear power industry will continue to dominate as shown in Figure 5. And, though lacking the large tonnage and higher grades found in Canada and Australia, US uranium resources will continue to hold some considerable attraction as a consequence of a history, in the United States, of political stability and non-interference in commercial matters. Finally, it should be noted that the current US producers are proving, by and large, to be a hardy, efficient, and cost-conscious lot.

Albeit of modest size, there will be a US uranium industry. ■

Figure 5
UNFILLED URANIUM REQUIREMENTS
BY REGION



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CANADIAN URANIUM AND THE US MARKET

By Clark M. Beyer

The following is a slightly edited version of a speech presented by NUEXCO Commercial Representitive Clark Beyer to the Canadian Nuclear Society's International Symposium on Uranium and Electricity in Saskatoon, Canada, on September 21, 1988.

Introduction

Canada and the United States are each others' largest trading partners. Across the longest undefended border in the world, each nation has invested over thirty billion dollars in its neighbor's economy. Trade in the energy sector is a major part of this relationship. For the last several years, Canada has produced far more uranium than any other region in the world.

Since free trade in uranium has been in effect in the USA, Canada's role as a supplier to the USA has increased substantially, and the USA currently imports more uranium from Canada than from any other nation. But in recent years, renewed attempts to protect the US uranium production sector have threatened to restrict or eliminate Canadian uranium sales to the USA, representing a threat to as much as one-third of Canada's uranium export market. These events have resulted in confusion among US utilities as to procurement decisions, and, depending upon the outcome of these political factors, could have a serious impact on sales and the price of Canadian-origin uranium over the next decade.

The US Market

Despite a far smaller industry than originally planned, the United States still has the largest nuclear capacity in the world. As of mid-1988, 104 nuclear units were in operation in the USA, representing annual uranium consumption of approximately 38 million pounds (14,600 MTU). Figure 6 shows NUEXCO's forecast of uranium consumption through the 1990s. As you can see, the US nuclear power industry has essentially completed its growth stage. Recurring regulatory and licensing problems, plant construction cost overruns, and the lack of strong public support for nuclear power in the wake of the Three Mile Island and Chernobyl accidents have led to a retrenching on the part of the US nuclear industry. On the positive side, the rash of reactor cancellations in the late 1970s and early 1980s has practically ended, and at least nine of the fifteen reactors still under construction should be in operation by 1995. As a result, uranium demand in the USA should stabilize at about 40-million pounds U_3O_8 (15,400 MTU) per year for the next decade.

Two other factors will determine the level of buying activity undertaken by US utilities in the 1990s—inventory levels and unfilled requirements. While uranium inventory levels still remain quite high among some US utilities, some on the order of five years' or more forward supply, the overall US inventory level has been reduced considerably in recent years. The current figure for uranium inventories in the USA is estimated by NUEXCO at roughly 110 million pounds U_3O_8 equivalent, or about 42,300 MTU. Of this total, about four-fifths is in the hands of utilities and one-fifth in the hands of producers. NUEXCO excludes material in the pipeline or in process from this estimate.

This inventory reduction has been partly due to ever-increasing consumption on the part of US utilities. Since 1984, more than 25 units have entered commercial operation. Uncertainties in the markets for both spot and long-term contracting have also encouraged inventory drawdown of late, as utilities have adopted a wait-and-see approach to the complicated issue of origin. As these legal and political uncertainties have persisted, many utilities have purchased only what is necessary for reactor operations, and have either preserved, purchased, or swapped enough US-origin material to carry them through a period of restrictions.

For the same reasons, longer-term contracting has been proceeding rather slowly in the last few years, especially considering the large amount of unfilled requirements in the mid-1990s (please refer to Figure 5 of the previous article). As is evident by this chart, US utilities are almost entirely uncovered for uranium after about 1995, and will need to purchase more than 15 million pounds of U_3O_8 equivalent to fill 1993 requirements. Whether that contracting will occur now or in 1992 is likely to depend on the resolution of the legal and political issues now hampering US utilities. Nevertheless, it is clear that US

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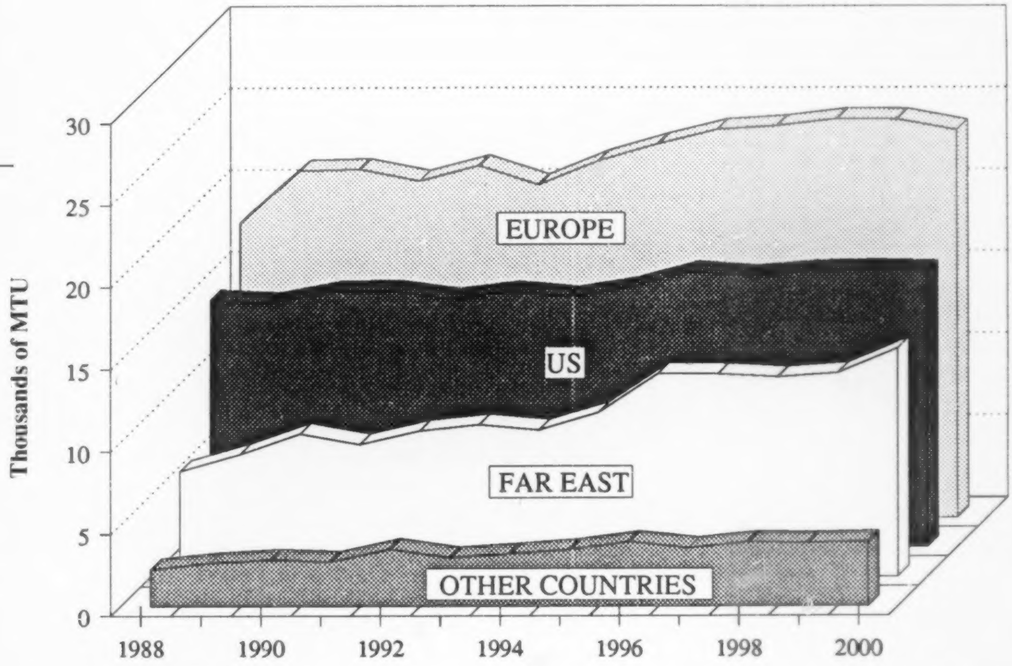
Figure 6
ANNUAL WORLD URANIUM CONSUMPTION



utilities will need to acquire a great deal more uranium for the 1990s than will Europe and the Far East combined. By briefly examining the US uranium production sector, it is evident that if the current state of the US industry continues, US producers will be able to meet only about 30 percent of US utility needs in the 1990s. US uranium production has fallen sharply since 1980 (Figure 1 of previous article), and exploration activity is at an all-time low. Those still engaged in uranium production have been forced to retrench, scale down operations, and only produce the most economical pounds. Conventional mining operations have shrunk as by-product and solution mining operations, typically less capital intensive, represent an increasing share of US production. More than 75 percent of US production in 1982 came from conventional operations; that figure dropped to about sixty percent in 1987. Only five conventional mills produced U_3O_8 concentrates in 1987, and most of them operated on a part-time basis.

Under current market conditions, and given the relatively poor average ore grades in the USA, NUEXCO expects that US producers will maintain a production level of roughly thirteen million pounds or five thousand tonnes per year through the early to mid-1990s. Conventional operations in the Arizona Strip and New Mexico, and to a lesser degree in Texas and Wyoming, should account for about half of this amount, with the balance coming from solution mining operations in Texas, Wyoming, and Nebraska, and phosphate by-product operations in Florida and Louisiana. Under such a scenario, US utilities would need to depend on imports and inventory drawdown for two-thirds of their needs in the 1990s.

Canada's Status as a Uranium Producer

In contrast to the rather grim future for US producers under free-market conditions, the outlook for Canadian uranium appears better than ever. In 1987, for the fourth year in a row, Canada led the world in uranium production, accounting for more than one-third of all U_3O_8 production worldwide. That achievement has firmly established Canada as the world leader, and the discovery

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of larger and richer deposits in Saskatchewan should assure that position well into the next century.

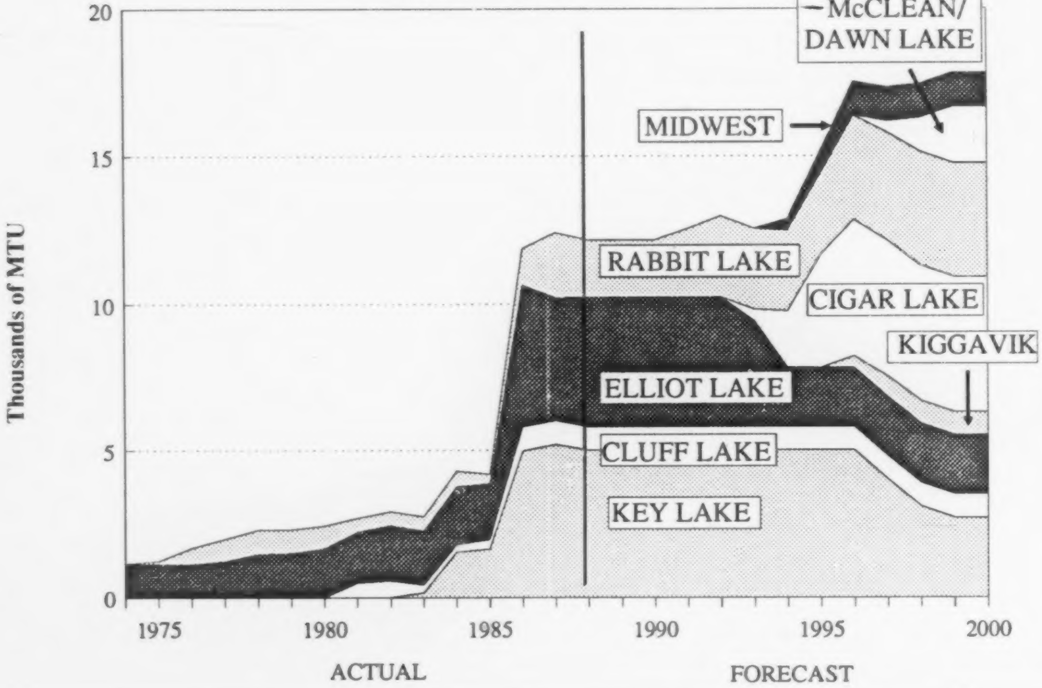
Figure 7 shows Canadian production since 1975, along with NUEXCO's projections for output in the 1990s, arranged by production center. Current output is dominated by the Key Lake project, which again exceeded rated mill capacity by producing 13.5 million pounds U_3O_8 (5100 MTU) in 1987. The Elliot Lake district of Ontario followed closely, although the district experienced a small decline in production due to a strike. The milling of high-grade ore from the Collins Bay "B" orebody increased output at the newly renovated Rabbit Lake mill to 5.7 million pounds (2200 MTU). Production at Cluff Lake remained slightly above two million pounds (770 MTU).

Looking once again at Figure 7, Nuexco expects the Key Lake project to continue anchoring Canadian production throughout the 1990s. The higher cost production centers of Eastern Canada could experience gradual declines, while newer projects in Saskatchewan and production at the Rabbit Lake complex should increase as the Eagle Point and Collins Bay deposits are fully exploited.

Aside from the success of those projects, a variety of new opportunities exist and could well come into production before the end of the century. Most promising from the standpoint of sheer size, and the discovery that has garnered the most attention in the industry, is the Cigar Lake deposit. Containing reserves of at least 385 million pounds or 148 thousand MTU at grades of five to fourteen percent U_3O_8, the Cigar Lake project could be underway as soon as 1993. The Saskatchewan Environment Department gave its approval for test mining in October 1987, and a two-year test mining program has been initiated to determine the technical feasibility of the project. The sinking of the exploratory test shaft began earlier this year.

Other promising deposits include Midwest Lake, which is currently undergoing feasibility studies, Dawn Lake, McClean Lake, and Kiggavik (Lone Gull) in the Northwest Territories. Undoubtedly, the success of the

Figure 7
CANADIAN URANIUM PRODUCTION
(By Production Center)



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current operating projects, combined with the favorable outlook for pending projects, will ensure and continue Canada's position as the world's largest uranium producer.

One major uncertainty on the horizon, however, involves the merger of the two largest participants, Eldorado and SMDC, into the government-owned Cameco. The competitive history of the two companies has had a significant effect on uranium prices in the past, and observers expect that what would have been separate and competing development plans for deposits such as Cigar Lake, Eagle Point, and Dawn Lake may now be centralized under a single plan. This rationalization of the mining plan, if it emerges, should have a positive effect on the market over the longer term, and probably makes economic sense in a worldwide market characterized by oversupply and weak prices. Until all of the details are clarified, however, it will be difficult to predict the extent to which the reduced competition will bolster the uranium market.

Political Developments

With Canada as the clear world leader in low-cost uranium production, the US production sector unable to fulfill US demand, and extremely close trade ties between the USA and Canada, normal commercial conditions would dictate that Canada would play perhaps the most significant role in US uranium supply during the 1990s. Indeed, that has been the case since the late 1970s, when free trade in uranium began to return to the US marketplace. Instead, we may now be returning to an era when political intervention overrides economic reality. As of mid-September, several serious complications to a free market were under debate in various political and judicial arenas. The outcome of these uncertainties will have a major impact on the uranium market and uranium trade between Canada and the USA.

In evaluating the various scenarios for artificial influence on the uranium market, one is struck by the complexity and seemingly endless possibilities for resolution. Without delving into every legal and administrative option available to the politicians, jurists, and government and industry negotiators, the following summarizes the major issues threatening free trade in uranium:

- **The US Producers' Lawsuit** has traveled through the US judicial system for the last four years. Based on an outdated provision in the US Atomic Energy Act, the suit alleged that the Department of Energy, the administrative body that provides uranium enrichment services to the worldwide market, is required to restrict the enrichment of non-US uranium for US utilities when the US uranium industry is no longer viable. Bolstered by DOE's own findings that the US production sector has been "non-viable" in the last three years, the Producers have prevailed in lower courts, beginning with the District Court decision in June 1986. That decision, under various appeals since then, required DOE to halt the enrichment of non-US uranium for US utilities until viability was restored. While under appeal, DOE has not been required to implement enrichment restrictions.

The appeal reached the US Supreme Court early in 1988, and a decision was announced on June 15. The Supreme Court reversed the lower courts' decisions in favor of the miners, and remanded (or sent back) the case to the lower court for further fact-finding. While it appeared to be a victory for DOE, the reversal and remand was essentially just another delay in the case while it is determined whether or not enrichment restrictions will help the US industry. The lower court has scheduled some hearings on the matter, but this fact-finding could last another year or longer. Eventually, a victory by DOE would continue the free-market conditions currently in effect. However, a victory by the US Producers could result in enrichment restrictions against foreign uranium for US utility use. The most obvious consequences of restrictions would be a significant premium for US-origin uranium as US utilities compete for available supplies, and weakness or stagnation in the world market as non-US producers compete for only two-thirds of their previous market. (This had been the case, although on a less severe scale, over most of 1987 simply because the market *expected* the US producers would win the case). Once again, because of the nature of the US court and appeal system, any resolution is likely to take considerable time.

- **Legislative Protection** for the US producers has been a recurring theme as several influential members of the US Congress have sought some form of taxpayer support for the ailing uranium industry. Until recently, these attempts have not been taken seriously by Congress, largely

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because a handful of uranium miners does not constitute a strong lobby in the US, and because of the Reagan Administration's general anti-protectionist stance. The latest bill involves a three-tiered approach to the various dilemmas of the US nuclear industry—relief for the miners via a government-subsidized uranium purchase program, allocation of funds for mill tailings cleanup, and the establishment of a private enrichment corporation to take over the enrichment operation from DOE. This attempt to solve all of the ills of the US nuclear industry has invariably garnered both wide support and wide opposition, but it appears to be making progress in the legislative arena. In early August, the US Senate passed a bill reorganizing the Nuclear Regulatory Commission with the aforementioned amendment attached, surprising much of the industry. The House vote is expected shortly, but the bill is likely to encounter much more opposition in the House, particularly due to the expensive subsidy that the government buying program would represent for the US uranium producers. The upcoming elections may further delay action on the bill and amendment.

As far as market implications go, it seems too early to tell what impact a buying program would have. At first glance, if the measure does succeed, it might appear to place upward pressure on world prices merely because of the added demand. However, there will certainly be a number of complicated rules governing the purchases, and the government demand is strictly artificial, implying that eventually the material will again be on the market. More importantly, with the exception of the US government, no utilities would be required to purchase or enrich a certain amount of US-origin uranium, so any new US-origin demand would be limited to the government program. Without being required to do so, few if any utilities can be expected to pay a significant premium for US-origin uranium, which thereby could actually reduce utility demand for US uranium, and increase the demand for lower-priced Canadian material. Under such circumstances, an artificial US market could exist with the government as the sole buyer at high prices, but in the real market the US producers would still have to compete with the other producers worldwide.

- **The US-Canada Free Trade Agreement** entered the picture last October, when Canadian and US trade negotiators agreed on a package of measures designed to remove existing tariffs and encourage free trade between the two countries. While avoiding the debate over the relative merits of the Agreement, it is apparent that the Agreement would foster true free trade in uranium. In exchange for the Canadian forfeiture of the upgrading requirement, the US agreed not to restrict the enrichment of Canadian uranium under Section 161(v) of the Atomic Energy Act, the focus of the Producers' Lawsuit.

There has been a great deal of debate over the FTA since it was signed by Prime Minister Mulroney and President Reagan in January, as both governments mobilize support for the Congressional and Parliamentary ratification necessary to implement it. If it is enacted, Nuexco expects free-market conditions to prevail, and Canadian producers would retain or improve on existing market share in the USA. Although the US Congress has ratified the implementing legislation, its passage in Canada appears less certain. Demanding that a national election be called before it would consider the FTA, the opposition Liberal Party has stalled the FTA legislation in the Canadian Senate. On October 1, 1988, in response to increasing pressure, Canadian Prime Minister Mulroney scheduled a general election for November 21. If the Conservatives win the election, there may be a chance that the FTA will be ratified in time for the January 1, 1989 effective date. A coalition or Liberal victory, or any other delays in the process, are certain to jeopardize the FTA's passage and implementation for 1989 and possibly beyond.

In closing, as the commercial uranium market enters its third decade, prices for Canadian uranium will be highly dependent on these interrelated factors. Most of these uncertainties appear to be drawing near some sort of resolution. In addition, the marketing and production decisions of the Cameco organization will undoubtedly have a significant impact on future price direction over the longer term. In the meantime, generally optimistic demand projections worldwide should provide some encouragement to producers in this oversupplied market. Canada's strength as a uranium producing nation has been based upon its low-cost structure, vast reserves, and its commercial history with the USA, the world's largest market. However, if history is any indication, real economic factors may be the least influential pressure on future uranium prices. ■

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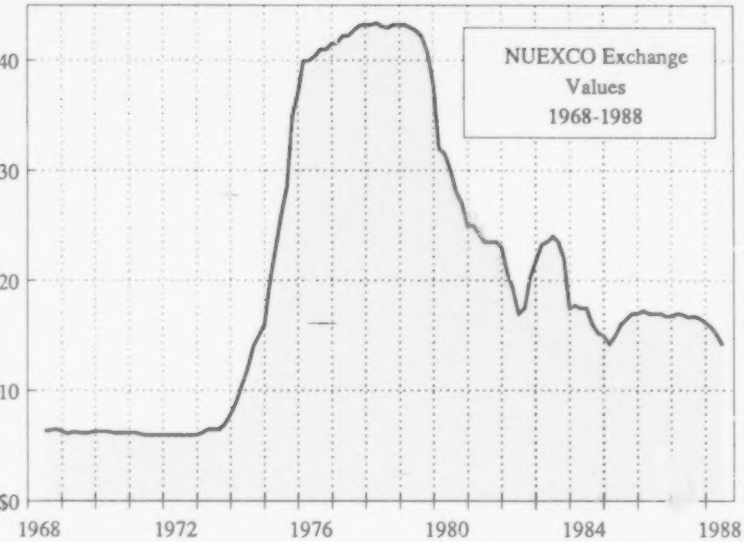
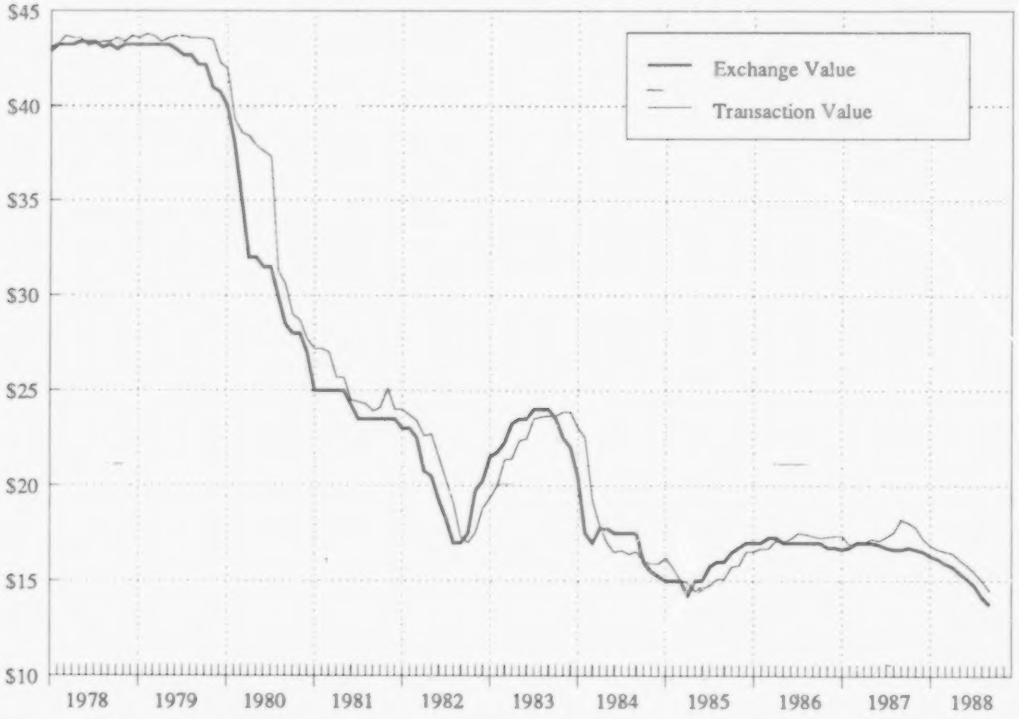
NUEXCO Historical Exchange and Transaction Values

(In US Dollars/Pound U_3O_8)





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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	**13.75**			

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	**0.00**			

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	**14.50**			

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.80	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	**1.95**			

HISTORICAL UF_6 VALUES

Determined as of the last day of the month indicated ($US/kg. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	**40.75**			

HISTORICAL US UF_6 PREMIUM (Relative to the UF_6 Value)

Determined as of the last day of the month indicated ($US/kg U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	**0.00**			

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay)

Determined as of the last day of the month indicated ($US per SWU)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	**65**			

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HISTORICAL MARKET DATA

VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]

(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8	Average Price in ECU per pound U_3O_8	Average Price in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75
1987	14,000	17.0	ECU 28.25	$32.50	ECU 15.00	$17.25

[1] The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales betwee[illegible]lities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

[4] Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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US URANIUM MARKETING ACTIVITIES STATISTICS[1]

(Compiled from data published by the US Energy Information Administration)

Year	Total Production[2] (million pounds U_3O_8)	Deliveries to Domestic Utilities[3] (million pounds U_3O_8)	Average Price of Delivered Uranium (\$/lb. U_3O_8)	Quantity of Uranium Imported[4] (million pounds U_3O_8)	Average Price of Imported Uranium (\$/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	n/a	n/a	3.6	n/a	1.2
1977	29.9	n/a	n/a	5.6	n/a	4.0
1978	37.0	n/a	n/a	5.2	n/a	6.8
1979	37.5	33.0[5]	\$23.85[5]	3.0	n/a	6.2
1980	43.7	35.0[5]	\$28.15[5]	3.6	\$43.10	5.8
1981	38.5	32.6[5]	\$34.65[5]	6.6	\$32.90	4.4
1982	26.9	27.1	\$38.37	17.1	\$27.23[6]	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.1P		\$27.45P	14.0P	\$19.31P	

P = Preliminary

[1] Sources: 1979: US Department of Energy, Assistant Secretary for Resource Applications, Office of Uranium Resources and Enrichment, *Survey of United States Uranium Marketing Activity*, DOE/RA-0053 (Washington DC, July 1980). 1980-1981: US Department of Energy, Assistant Secretary for Nuclear Energy, Office of Uranium Enrichment and Assessment, *Survey of United States Marketing Activity*, DOE/NE-0013 and DOE/NE-0013/1 (Washington DC, June 1981 and July 1982). 1982: Energy Information Administration, *1982 Survey of United States Marketing Activity*, DOE/EIA-0403 (Washington DC, September 1983). 1983: Energy Information Administration, *Survey of United States Marketing Activity 1983*, DOE/EIA-0403(83) (Washington DC, August 1984). 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985). 1986: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1986). 1987: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey"(1987).

[2] Sources: 1976-1982: US Department of Energy, Grand Junction Area Office, *Statistical Data of the Uranium Industry*, GJO-100 (Grand Junction, Colorado, January 1983). 1983: Calculated by the staff of the Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, from US Department of Energy, Grand Junction Area Office data files. 1984: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1984). 1985: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1985).

[3] Excludes direct imports by domestic utilities.

[4] Includes imports by domestic utilities and domestic suppliers.

[5] Includes delivery commitments to domestic utilities and agents.

[6] Computation of quantity-weighted average price excludes the quantity associated with a large exchange (swap) transaction that occurred in 1982.

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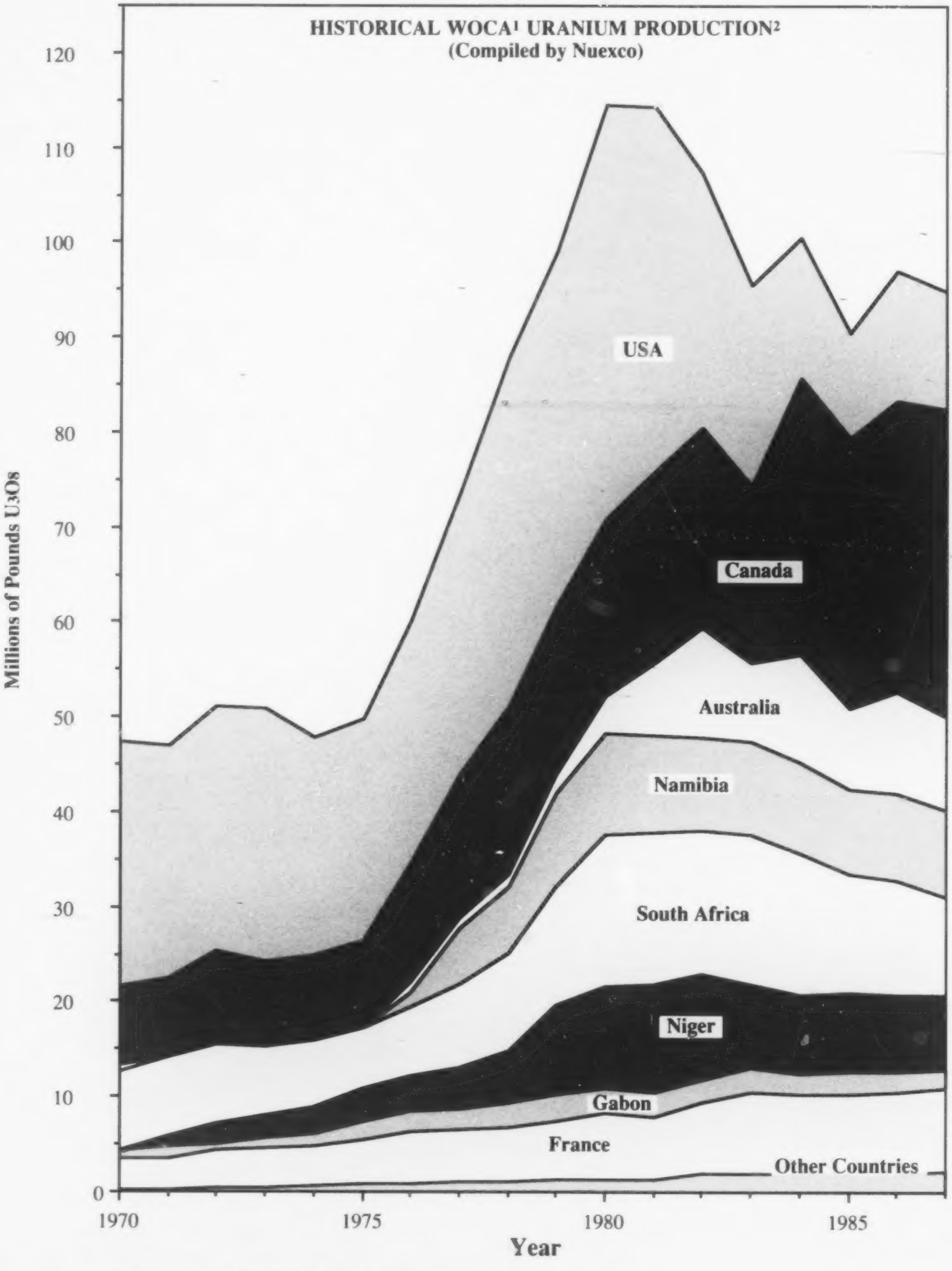

HISTORICAL WOCA[1] URANIUM PRODUCTION[2]
(Compiled by Nuexco)

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[1] WOCA = World Outside of Centrally-Planned Economic Areas.
[2] 1987 production data are preliminary.

AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1976=100)
1975	Avg.[4]	57.9	36.3	82.1
1976	Avg.	65.7	40.7	99.7
1977	Avg.	73.8	46.3	110.8
1978	Avg.	79.7	52.0	117.7
1979	Avg.	86.9	69.5	127.9
1980	Avg.	95.8	83.1	140.8
1981	Avg.	105.0	85.9	154.1
1982	Avg.	116.7	89.0	174.9
1983	Avg.	128.5	96.9	181.9
1984	Avg.	133.6	98.0	194.4
1985	Avg.	142.6	107.3	198.7 (Jan - May)
				101.1 (Jun - Dec)[5]
1986	Avg.	155.5	101.5	104.9
1987	Avg.	168.7	108.9	—
Jan	1987	—	106.2	108.8
Feb	1987	—	108.9	108.8
Mar	1987	164.7	108.4	111.7
Apr	1987	—	108.3	111.7
May	1987	—	108.1	111.7
June	1987	167.2	108.1	111.8
July	1987	—	108.7	111.9
Aug	1987	—	110.5	111.9
Sep	1987	170.0	109.3	112.1
Oct	1987	—	108.6	112.2
Nov	1987	—	110.0	112.2
Dec	1987	172.9	111.9	112.3
Jan	1988	—	112.4	112.4
Feb	1988	—	112.3	114.2
Mar	1988	176.0	112.3	114.3
Apr	1988	—	112.4	114.3
May	1988	—	114.1	—
Jun	1988	—	114.0	—

P = Preliminary **R** = Revised since last month

[1] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

[2] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[3] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[4] Monthly data for the period 1967 to 1986 appear in Report 233.

[5] Base: June 1985 = 100 and includes salary earners as well as wage earners.

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GOVERNMENT STATISTICS

CANADA

				Wage-earner Data: Average Hourly Earnings (C$)[2]				
		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1979	Avg.	80.0	80.7	—	—	—	—	—
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
Jan	1987	120.0	135.2	19.53	16.93	16.03	12.58	12.89
Feb	1987	119.8	135.8	20.33	17.20	16.21	12.66	13.11
Mar	1986	120.4	136.4	20.04	17.14	16.15	12.58	13.02
Apr	1987	121.2	137.0	20.47	17.38	16.26	11.99	13.27
May	1987	122.0	137.8	20.50	17.12	15.96	11.44	13.19
June	1987	122.5	138.2	20.23	16.94	15.70	12.77	12.88
July	1987	123.2	139.2	19.75	16.73	15.63	12.52	12.98
Aug	1987	123.8	139.3	19.64	16.98	15.87	12.65	13.03
Sep	1987	124.1	139.3	19.85	17.20	16.25	12.57	13.40
Oct	1987	124.5	139.8	20.06	17.31	16.33	13.01	13.37
Nov	1987	125.1	140.4	20.47	17.50	16.50	12.63	13.53
Dec	1987	125.5	140.5	20.62	17.31	16.37	12.54	13.75
Jan	1988	126.4	140.8	20.70	17.54	16.65	12.82	13.73
Feb	1988	125.9	141.3	20.94	17.97	17.07	13.01	13.69
Mar	1988	126.2	142.0	20.55	17.88	16.78	13.10	13.62
Apr	1988	126.8	142.5	20.03	18.50	15.92	13.32	13.66
May	1988	127.2	143.4	20.92	18.21R	17.03	13.02	13.58
Jun	1988	127.1	143.6	21.04	18.31R	16.95R	13.03R	13.76R
Jul	1988	128.0	144.5	20.86P	18.30P	16.88P	12.95P	13.64P
Aug	1988	128.1	144.9	—	—	—	—	—

P = Preliminary **R** = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1980 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1975	Avg.	16.71	—	29.4	52.1	639,473	1,003,217
1976	Avg.	19.30	—	32.7	59.9	671,240	1,212,983
1977	Avg.	23.87	—	36.3	67.7	712,006	1,420,670
1978	Avg.	27.14	—	40.3	74.3	658,261	1,502,975
1979	Avg.	30.18	—	45.6	85.6	686,599	1,795,638
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	—	—	137.7	246.8	750,256	—
Jan	1987	—	—	128.9	233.9	750,496	529,682
Feb	1987	—	—	130.3	237.0	758,230	600,258
Mar	1987	88.17	197.1	132.4	239.6	763,003	536,033
Apr	1987	—	—	134.1	242.5	765,309	535,876
May	1987	—	—	135.6	243.6	761,026	531,732
Jun	1987	90.74	203.5	136.6	244.9	763,319	571,407
July	1987	—	—	138.2	246.8	764,810	624,954
Aug	1987	—	—	140.2	249.9	761,338	564,387
Sep	1987	100.79	224.7	142.0	252.4	742,417	587,707
Oct	1987	—	—	143.6	255.5	725,599	599,116
Nov	1987	—	—	144.8	256.3	734,630	616,725
Dec	1987	100.34	267.0	145.9	258.3	712,896	613,262
Jan	1988	—	—	147.2	261.5	711,983	615,889
Feb	1988	—	—	148.2	265.7	730,313	621,757R
Mar	1988	102.90R	234.0	150.2	268.4	—	619,117
Apr	1988	—	—	151.9	272.7	—	621,757
May	1988	—	—	153.1	276.1	—	—
Jun	1988	103.59	234.0	153.6	278.2	—	—
Jul	1988	—	—	155.3	—	—	—

P = Preliminary **R** = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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GOVERNMENT STATISTICS

UNITED STATES

		Producer Price Index[1]		Consumer Price Index[2] (1982-1984 = 100)	GNP Implicit Price Deflator[3] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	111.2	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	114.1	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	—	12.52	12.98	12.37	9.88
Jan	1987	100.4	100.5	111.2	—	12.72	12.96	12.17	9.82
Feb	1987	100.8	101.0	111.6	—	12.63	12.80	12.21	9.82
Mar	1987	101.1	101.2	112.1	116.1	12.58	12.76	12.24	9.82
Apr	1987	101.6	101.9	112.7	—	12.51	12.84	12.30	9.81
May	1987	101.9	102.6	113.1	—	12.50	12.87	12.32	9.81
Jun	1987	102.4	103.0	113.5	117.2	12.52	12.88	12.28	9.83
Jul	1987	103.1	103.5	113.8	—	12.41	13.02	12.37	9.86
Aug	1987	103.7	103.8	114.4	—	12.40	13.01	12.33	9.98
Sep	1987	103.5	103.7	115.0	117.8	12.50	13.29	12.56	9.94
Oct	1987	104.0	104.1	115.3	—	12.42	12.99	12.50	9.92
Nov	1987	104.2	104.2	115.4	—	12.54	13.11	12.55	9.98
Dec	1987	104.1	104.1	115.4	118.7	12.60	13.14	12.61	10.03
Jan	1988	104.3	104.5	115.7	—	12.77	13.03	12.55	10.02
Feb	1988	104.6	104.8	116.0	—	12.71	12.96	12.55	10.02
Mar	1988	104.7	104.9	116.5	119.4	12.59	13.17	12.53	10.04
Apr	1988	105.6	105.8	117.1	—	13.08	13.17	12.57	10.09
May	1988	106.1	106.5	117.5	—	12.99R	13.09	12.59	10.12
Jun	1988	106.5	107.4	118.0	120.6	13.17R	13.12	12.60	10.15
Jul	1988	106.7	107.8	118.5	—	13.18P	13.26P	12.70R	10.12R
Aug	1988	107.1	108.0	119.0	—	—	—	12.64P	10.12P

P = Preliminary **R = Revised since last month**

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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NUEXCO

EXECUTIVE SUMMARY
REPORT 242
(All data as of September 30, 1988)

Exchange Value **\$13.75, down \$0.40**	The **Exchange Value** is **\$13.75** per pound U_3O_8, down \$0.40 since last month. The **US Premium** (relative to the Exchange Value) is unchanged at **zero**.
UF_6 Value **\$40.75, down \$0.25**	The **UF_6 Value** is **\$40.75** per kg U as UF_6, down \$0.25 since last month. The **US Premium** (relative to the UF_6 Value) remains at **zero**.
Transactions	**Nine** recent natural uranium sales are reported, involving approximately **2.4 million** pounds equivalent U_3O_8. Six of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **5.3 million** pounds U_3O_8 equivalent, a decrease of 2 million pounds since last month. Active spot and near-term **uranium demand** totals **1.0 million** pounds, down 600,000 pounds since last month. The spot and near-term **supply-demand ratio** increased to **6.0** to **1**.
Transaction Value **\$14.50, down \$0.50**	The **Transaction Value** is **\$14.50** per pound U_3O_8, **down \$0.50** since last month. The calculation includes 17 transactions involving a total of nearly 2.7 million pounds U_3O_8 and equivalent UF_6 and covers a period of 3 months.
Loan Rate **3.5%, unchanged**	The **Loan Rate** is **3.5 percent** per annum, unchanged. No loan transactions are reported.
Conversion Value **\$1.95, unchanged**	The **Conversion Value** is **\$1.95** per pound U as UF_6, unchanged since last month. One secondary market transaction for conversion services took place this month. Active demand totals 2.5 million pounds U as UF_6.
SWU Value \$65, unchanged	The **SWU Value** at 0.3% tails assay remains at **\$65** per SWU. Three secondary market SWU transactions and one enriched uranium product transaction are reported.
	* * *
Recent Developments	Increased opposition to nuclear energy in the Federal Republic of Germany causes delays in its nuclear program. Finland's industrial sector calls for additional nuclear power plants in the 1990s. By expressing its "desire" and "objective" to sign the NPT, the Republic of South Africa averted suspension from the IAEA for an additional year.
Analysis and Commentary	Although the US uranium production industry will never return to its former dominance, it is expected to stabilize at approximately 40 percent of US consumption, or about 6,500 MTU annually. Future price levels and sales opportunities for Canadian-origin uranium in the USA, which imports approximately one-third of Canada's uranium production, will be significantly directed by the outcome of ongoing political and legal proceedings.

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